Electrical Review

THE PIONEER ELECTRICAL WEEKLY OF AMERICA.

VOL. XL. No. 13. NEW YORK, SATURDAY, MARCH 29, 1902. ISSUED WEEKLY.

ELECTRICAL REVIEW

PARK ROW BUILDING

13-21 PARK ROW - - NEW YORK

P. O. BOX 339

BY THE

ELECTRICAL REVIEW PUBLISHING COMPANY

CHARLES W. PRICE
PRESIDENT AND TREASURER

STEPHEN H. GODDARD
SECRETARY

CHARLES T. CHILD
TECHNICAL EDITOR

RUSSELL HOWLAND
GENERAL REPRESENTATIVE

WESTERN OFFICE
40 DEARBORN STREET, CHICAGO

LONDON OFFICE
42 OLD BROAD STREET, LONDON, E. C.

REGISTERED CABLE ADDRESS
"ELECTVIEW" - - NEW YORK
TELEPHONE CALL, 21 "CORTLANDT"

(PRIVATE BRANCH EXCHANGE CONNECTING ALL DEPARTMENTS)

SUBSCRIPTIONS TO THE
ELECTRICAL REVIEW

One Year, United States and Canada - - - $3.00
One Year, Foreign Countries - - - - 5.00
Single Copies, each - - - - - - - - .10
Copies can be supplied for only one year back at 25 cents each

TO ADVERTISERS

CHANGES for advertisements should be in this office by Friday noon for the following week's issue.

NEW ADVERTISEMENTS should be in the office not later than Monday noon to ensure publication in that week's issue.

On other pages of this issue Dr. William Rollins describes at length the method employed in making one of his induction coils—a type which has given highly satisfactory performance—and brings out very clearly the reasons underlying the successful building of such coils for any purpose. There are so many mistakes that are easy to make in the design and construction of such coils and so many amateurs are undertaking the task of building them that Dr. Rollin's article is of particular value, especially to those contemplating making a coil.

ELECTRICITY FOR LARGE RAILWAYS.

The British technical press is at present much exercised over the discussion of a paper recently presented by Mr. James Swinburne before the Institution of Electrical Engineers. In this paper Mr. Swinburne undertook to lay down a definite scheme for the application of electricity to main-line railways and suggested, as the probable solution of the various difficulties that were encountered, the use of single-phase current with a synchronous motor-driven direct-current dynamo on the locomotive, and either a modification of the multiple-unit system for the motors or the application of the well-known Ward-Leonard method of control to the direct-current motors used for propulsion. With great heartiness and unanimity the British technical press has attacked this proposition.

The situation of electric traction with regard to main-line railways may be stated briefly as follows: Direct-current motors have enormous advantages where frequent starting is necessary, or wherever a high rate of acceleration is to be attempted. Direct-current motors can not be made to operate successfully at more than seven hundred volts. Seven hundred volts is too low a pressure for economical transmission to distances greater than a few miles. On this account the well-known converter substation distribution method has been evolved. This is satisfactory, in one way, for any reasonable distance of transmission, but is enormously costly on account of the expensive apparatus at the substations and the high labor costs necessarily involved in their operation. The use of polyphase motors on the train permits the highest economy to be attained in the distribution system, the substations being replaced by transformers which require only occasional attention. But from necessity this method introduces the extreme difficulty of operating two or more parallel working conductors—a thing against which all electric railroad experience is unanimous. Obviously, since the single-phase current enjoys all of the advantages of transformability and can be fed from a single trolley wire or working conductor, it is the thing to use provided it can be applied properly to produce motion of the train. Single-phase induction motors are very far from being satisfactory, and consequently the rather complicated plan suggested by Mr. Swinburne has been evolved.

The whole discussion shows only one thing with great clearness. This is that the problem of applying electricity to the operation of trains on large railways differs so materially from the problems met in ordinary trolley-road practice as to constitute an entirely new branch of the subject. It seems reasonably evident to anybody that the solution of the railway difficulty involves the use of alternating current, and it is certainly evidently desirable to use the single-phase variety if it can be done. It appears, therefore, that the key to the situation will probably be discovered in the design of single-phase apparatus directly operated from the trolley current for propelling the car. For this we must apparently wait, since it is not likely that present forms of single-phase apparatus will be satisfactory. The alternative which has been presented is unquestionably satisfactory in all its elements except that of great first cost and an undue complexity of apparatus.

THE AMERICAN ELECTROCHEMICAL SOCIETY.

The call that has been sent out for a meeting of those interested in electrochemistry, and the formation of a society along the lines of the other engineering societies, has met with an unexpectedly large response and it is now evident that a society of considerable magnitude will be formed at the Philadelphia meeting on April 3. This is an indication of the importance which this newest branch of electrical development has already assumed

and may be regarded as prophetic, perhaps, of a future which seems to hold out the highest promise. The new society will certainly have the best wishes of its elder sisters in the various other branches of engineering, and if it is properly organized and well managed will be a power in the development of this most interesting and important field.

One thing that may be suggested to it is a propaganda of enlightenment to make the public in general, and engineers in particular, understand the increasing importance of electrochemical work. The art has grown so fast that few engineers who have been connected with the mechanical development of electricity have any adequate idea of the magnitude or importance of the results that may be expected to flow from electrochemical development.

THE KAISER AND WIRELESS TELEGRAPHY.

A news despatch from Germany relates that the German Emperor has ordered the exclusive employment of the Slaby-Arco system of wireless telegraphy on German warships and coast stations, which it is thought will lead to the general adoption of this system by the German mercantile marine. It is also stated that the government is preparing a law by which stations of the Marconi system will be prohibited in Germany, for the reason that the opinion is entertained that Mr. Marconi is attempting to secure a world monopoly in wireless telegraphy, which design the German Government wishes to frustrate.

The natural question arises, what use would a wireless system be for coast stations unless it could communicate with vessels equipped with the system generally standard in maritime countries?

The work of Professor Slaby in this direction has been most important and, from the somewhat meagre news of it published in the German technical papers, he seems to have arrived at results of considerable value. While it seems to be demonstrable that commercial wireless telegraphy will require tuned systems, yet the more evident use of the system in signaling between the shore and ships, both for purposes of commerce and of warning in case of danger, seems to require a universal system equally responsive to all varieties of sending apparatus. Indeed, for purposes of communication at sea, as for example, in the case of a disabled vessel sending out a call for help, a tuned system would so limit the availability of wireless telegraphy as to be practically of no value.

Like the telephone, wireless telegraph bears all the ear-marks of another "natural monopoly." To be of any particular use it must be universal and universally available. The effect of the Kaiser's position with regard to the nature of the systems to be used in Germany will be interesting to watch, but it may safely be predicted that the necessities of such intercourse as may be carried on by any wireless system will require that, whatever its origin, it work in harmony with the Marconi or other systems which may be installed elsewhere, particularly on vessels of other nationalities.

THE BRITISH NATIONAL PHYSICAL LABORATORY.

On March 19 the Prince of Wales opened the National Physical Laboratory at Bushey Park, England, with appropriate ceremony. This institution is interesting in many ways, particularly so on account of its forming concrete evidence of the awakening realization in Great Britain of the necessity for the application of science to commerce and manufacture.

For the past few years the British have been compelled to see the better educated Germans and Americans take away from them much of their industrial and commercial supremacy. Many new and important industries have grown up around the applications of science, as for example, the whole range of the electrical arts and much of modern metallurgy and machinery manufacture. Indeed to-day, in almost every branch of industrial activity there is the need for skilled men and for scientific knowledge in the application of natural principles to the work in hand. This new laboratory forms practically the first instance of the government of Great Britain taking part in scientific research. It is believed and hoped that the effect of the laboratory will be very largely to increase the general total of technical knowledge among British engineers and workmen.

It is interesting in this connection to notice that private benefactions to institutions of technical learning in the United States last year amounted to about eight times the total of the governmental grant of funds from the excise duties to maintain the entire bulk of English technical schools. This state of things, however, will apparently not long continue. In Birmingham no less a sum than £420,000 has been publicly subscribed toward the cost of a new technical university, while in Ireland two schools are being built in Dublin and Belfast at the cost of about £100,000 each. The new Manchester Institution of Technology has also recently been opened with an equipment of apparatus which alone cost over £60,000. At Glasgow another great technical institute is about to be erected at large expense. All of these indications go to show an awakening of interest in scientific matters in Great Britain which can not fail to have a large and highly beneficial effect upon the industry and the manufactures of that country.

ELECTRICITY IN MINES.

On another page of this issue will be found an interesting group of electric mining notes, referring particularly to the situation in Europe. On that continent, as in America, electricity has already been demonstrated to be in most respects the most available variety of power for use in mine working. Only in certain varieties of mines, where ventilation is of great importance, is the rivalry of compressed air at all serious.

In the United States, especially in coal-mining, electricity has come into very large use, the same mains often being used for lighting the mines, for operating coal-cutting and drilling machines at the headings and for working tramroads in the mines, and as well, perhaps, for pumping water. The great ease with which electrical apparatus may be installed and conductors may be led about the workings has made this variety of power more satisfactory than any that had been devised up to the time of its introduction.

In coal-mining, particularly as the more early worked seams are exhausted, the workings become deeper and more difficult and the future appears to offer even a larger field for the application of electric machinery to this enormous industry than does the present.

ON THE CALORIMETRIC PROPERTIES OF THE FERRO-MAGNETIC SUBSTANCES.

BY BRUCE V. HILL.

No. 1—It is known that the ferromagnetic substances when heated through a certain interval of temperature, this interval depending upon the nature of the substance, pass over, with absorption of heat into an allotropic form in which they are unmagnetic. A number of facts go to show that a real transformation has taken place and that the change in the properties of these bodies is not due merely to the increased temperature. Dr. Monis found that iron becomes again magnetic between the temperatures of 800 degrees and 1,000 degrees centigrade. (*Phil. Mag.*, September, 1897.) The properties of the compounds of iron and nickel above and below the critical temperatures are also quite different. The magnetic oxide of iron, Fe_3O_4, prepared at lower temperatures has, according to M. Moissan (*Comptes Rendus* t. xxi, p. 199), a density of 4.86 and was attacked by concentrated nitric acid. If heated in an inert gas to a temperature above 1,000 degrees centigrade, this oxide was transformed; its density became 5.09, and it was not attacked by the concentrated acids. The oxide in its first form, if heated in air to a dull red, was transformed to the sesquioxide. In the second form it suffered no alteration. There are also two varieties of the protoxide. That prepared at lower temperatures is pyrophoric. If heated above 1,000 degrees centigrade in an inert gas it ceases to be pyrophoric. If the sesquioxide be prepared by the moderate calcination of a nitron salt of an organic acid, it is magnetic and is soluble in the dilute acids. With the sesquioxide prepared at high temperature the reverse is the case. These illustrations could be multiplied and similar ones given for the compounds of nickel. In the case of the metals themselves, however, it is difficult to compare the properties of the two modifications because both forms can not be had at the same temperature. The discovery of J. Hopkinson, however, has rendered this possible for certain alloys of iron and nickel (Proc. Roy. Soc., December 12, 1889, etc.). These alloys, when brought into the unmagnetic condition by heating, remain, after again cooling to room temperature, in a meta-stable non-magnetic condition, and resume their magnetic properties only after being cooled to a considerably lower temperature. After this cooling they now remain stable in the magnetic condition till again heated to the point of transformation. Many of these alloys, which Guillaume has called "irreversible," can be obtained in either condition between 20 degrees and 300 degrees centigrade, and hence are well fitted for a comparison of the properties of the two forms.

In the following experiments this comparison is made for some specimens of nickel steel (No. 5). The properties of two specimens made possible the determination of the latent heat of transformation (No. 6). Finally the results of No. 5, according to which the specific heat in the magnetic condition is always less than in the unmagnetic, are extended to the case of iron alone.

No. 2—The measurements of the specific heat were, for the most part, made by the method of mixtures, with carefully standardized thermometers. A few experiments were also made with the Bunsen ice calorimeter. In the former, the results are given in terms of the 15-degree water calorie; in the latter, in terms of the mean-water calorie between 0 degree and 100 degrees.

No. 3—The induction curves were taken with the Kopsel apparatus, but in the following results the magnetic condition is characterized by the induction B for a given field strength, H, upon the initial curve, and indicated by the sign Bh.

No. 4—The specimens of nickel steel used in these experiments were in the form of cylindrical bars 4 to 6 mm. in diameter. They were kindly supplied by the Société Anonyme de Commentry Fourchambault et Decazeville, and are here designated by the factory numbers. The analyses were also furnished by the society.

No. 5—No. 748, Ni 24.10, Co 359, Mn 0.410, the remainder iron. When this specimen was received it was very nearly unmagnetic. After cooling to —78 degrees it became weakly magnetic and after cooling to —180 degrees strongly so. ($Bh = 7{,}200_{12}$). The density in the magnetic condition was 7,906; unmagnetic, 8,091.

No. 775, Ni 24.04, Co 343, Mn 0.506. After heating to redness and allowing it to cool to room temperature this specimen was very feebly magnetic (permeability 2).

Bh was then found upon cooling to

0°	−20°	−79°	−180°
1200_{136}	3700_{135}	9300_{135}	10300_{135}

In the following table Cm refers to the specific heat in the magnetic state, determined after cooling to the temperature of liquid air. Cn refers to the specific heat in the unmagnetic or very weakly magnetic condition, determined after heating to redness.

Specific Heat Between	No. 748. Cm.	No. 748. Cn.	No. 775. Cm.	No. 775. Cn.
0° and 18°	0.1021	0.1086	0.0924	0.0992
20° " 100°	0.1126	0.1189	0.1136	0.1158 *
20° " 270°	0.1239	0.1343	0.1222	0.1235 *

When the specimen No. 775 was brought, for the first time after being heated to redness, into the ice calorimeter, it gave off a greater quantity of heat than by the second cooling from 18 degrees to 0 degree. This difference corresponded to the latent heat of transformation into the weakly magnetic condition $Bh = 1200_{136}$. It amounted to 2.783 calories per gramme of the alloy.

The specific heat is, then, even smaller in the magnetic than in the unmagnetic condition. This difference, Cn — Cm, decreases in general, with rising temperatures, as is shown especially by No. 775. In this connection Pionchon found the specific heat of iron from 0 degree to 600 degrees, that is in the magnetic condition below the temperature of transformation, to increase from 0.110 to 0.215. After the transformation, that is, in the unmagnetic condition, the specific heat between 723 degrees and 1,000 degrees was constant and equal to 0.218. (Pionchon, *Ann. de Chem. et de Phys.* (6), xi, p. 33, 1887.)

No. 6—A third specimen, No. 834, contained Ni 14.64, C 0.075, Mn 0.540. After heating, this alloy fully regained its magnetic properties at + 20 degrees and showed an induction $Bh = 13200_{130}$. In order to study the return to the magnetic condition more closely I heated the bar to redness and quickly placed it while still red hot in an induction coil, which was surrounded by an oil bath at 300 degrees, and allowed the whole slowly to cool, measuring the induction from time to time ballistically. In this way it was found that the magnetism began to reappear at + 200 degrees and increased gradually to + 20 degrees. When the bath was reheated the permeability showed no observable decrease up to 300 degrees. It was possible, accordingly, to determine the specific heat, Cm, in the magnetic condition by heating the substance in the oil bath to 200 degrees and then bringing it into the calorimeter. In this way Cm between 20 degrees and 200 degrees was found to be 0.1180.

The properties made it possible to measure the latent heat of the transformation for the interval of temperature from 200 degrees to 20 degrees. This was done in the following way: The substance was brought into the unmagnetic condition by heating to redness; it was then placed in the oil bath where it remained at the temperature 200 degrees for an hour. The

* These two specimens had been heated to redness and then cooled only to room temperature.

metal was, of course, not in contact with the oil, but in air. It was now put into the calorimeter where it cooled to +20 degrees, and at the same time passed into the magnetic condition. Let L be the latent heat of transformation, m the mass, c the specific heat between 20 degrees and 200 degrees, t_2 the initial temperature of the substance, t_3 its final temperature. The heat given to the calorimeter is then:

$$W = L\,m + c\,(t_2 - t_3)\,m.$$

If for c we put the value C 20 — 200, obtained above for the magnetic form, we obtain L = 13.45. It would be more exact to put $c = \frac{Cn + Cm}{2}$. However, according to the results given in No. 5, the difference Cn — Cm is only 0.001, approximately, and the assumption that c = Cm makes L only 0.1 too large.

No. 46, containing Ni 15.20, C 0.256, Mn 0.896, also wholly recovered its magnetic properties at room temperature. In the same manner as with No. 834, the value of L was found for this specimen to be 13.16.

If each of the two metals, iron and nickel, had its own heat of transformation, and if we apply Van't Hoff's theory of dilute solutions, according to which the point of transformation of each constituent is depressed by the presence of the other, then in this alloy, containing but fifteen per cent of nickel, the heat of transformation measured above is that of iron alone. For the latent heat of iron we have then,

$$13.5\,\frac{100}{85} = 15.9.$$

The propriety of this method of calculation is, however, open to question.

For reversible alloys the theory of dilute solutions gives for small depressions of the temperature of transformation:

$$\frac{d\,L}{d\,T} = Cn - Cm + \frac{L}{T}$$

where T is the absolute temperature of transformation of the substance.

If further for the irreversible alloys here studied, t_1 be the temperature of transformation from the unmagnetic to the magnetic state and t_2 the temperature of the reverse transformation, we have, as Professor Warburg has given,*

$$L_2 - L_1 = \int_{t_1}^{t_2} (Cn - Cm)\,d\,t.$$

Suppose now a closed cycle to be performed upon the body by bringing it from the magnetic condition at t_1 into the unmagnetic at t_2, and then again to the magnetic at t_1. As under constant pressure no external work is done the total quantity of heat given to the body must be zero. Then from the preceding formula the latent heat L_2 at the temperature t_2 must be greater than that L_1 at t_1. From No. 5, however, this difference can only be very small. From the cooling curve of iron Hopkinson* concluded that the latent heat of transformation was about 150 times the specific heat, which gives, in any case, a value greater than 16. Pionchon† obtained from calorimetric experiments the much smaller value 5.3 in the small interval 66 degrees — 723 degrees.

No. 7—The specimen No. 830 contained Ni 14.44, C 1.027, Mn 1.222. At room temperature this specimen was unmagnetic even after cooling in liquid air.

In the liquid air the bar was feebly magnetic. It gave

C 20 — 100 = 0.1225. C 20 — 270 0.1291.

The alloy is very hard and brittle, resisting the file, but breaking easily.

No. 8—According to the view of F. Osmond,‡ iron at ordinary temperatures is a mixture of the two modifications of iron, the magnetic α iron and the unmagnetic β iron. The properties of hysteresis depend upon the amount of β iron contained, so that the process of hardening by drawing or tempering increases the proportion of β iron. If this be correct we should expect from No. 5 that the hardening would increase the specific heat.

In the following table are given the specific heats of various varieties of iron variously handled. The two specimens of transformer iron were supplied by the Physikalisch-Technischen Reichsanstalt. The values given for iron wire and for steel refer in each case to the same specimen treated in different ways.

	Bh.	C_{20-100}	C_{0-18} (ice cal.)
Transformer iron (1).	19750_{132}	0.1114	0.0815
Iron wire annea ed...	18500_{132}	0.1146	0.0967
Transformer iron (2).	17400_{132}	0.1148	0.0975
Iron wire drawn.	17300_{132}	0.1162	0.0986
Steel, annealed.....	14000_{181}	0.1178	0.1066
Steel, tempered.....	8990_{181}	0.1188	0.1080

This table not only fulfills the above expectation, but shows also that, in general, the greater the magnetic permeability of iron the less is the specific heat, or, we may say, the greater the proportion of α iron the less the specific heat. These differences increase as the temperature falls.

Taking the results of No. 5 also into consideration one may say that, in all the ferro-magnetic substances studied, the specific heat increases with increasing proportion of the unmagnetic modification.

Berlin, Physikalisches Institute,
June, 1901.

* Here, as in the preceding equation, a definite temperature of transformation has been assumed, whereas, in fact, the transformation extends over a considerable range of temperature.

* J. Hopkinson, *Phil. Trans.*, Roy. Soc., London, 180 A; pp. 443 to 465, 1889.

† Pionchon, *Ann. de Chem. et de Phys.* (6), xi, p. 77, 1887.

‡ F. Osmond, "Critical Points of Iron and Steel," p. 17, 1890; *Phil. Mag.* (5), xxix, p. 511, 1890.

Experiments in Long-Distance Telephony.

With a view to giving the provinces the advantage of direct telephonic communication, experiments have been going on in the North of England. According to a statement in the London *Electrical Engineer* during official tests by the Post Office authorities in Leeds, it was found possible to speak with Boulogne, a distance of about 300 miles. It is understood that this is the first occasion on which a telephone message has passed between any provincial town in the North of England and the Continent, with the exception of Liverpool, which was also recently the scene of similar experiments. In this case it was found possible to carry on a telephonic communication with Paris, the distance covered being about 500 miles. Further south than Paris, however, the speaker could only be heard in Liverpool under very favorable conditions. It is said that one result of these experiments has been the abandonment of the scheme to attempt telephonic connections between London, Turin and Milan, the opinion being that these cities are too far apart to be embraced in a telephone circuit. It is to be noted, however, that the distance one can speak with the telephone largely depends on the wires through which the message has to be transmitted, and that the non-success of the authorities to obtain a satisfactory connection with the telephone between Liverpool and towns south of Paris only applies to the particular circuits on which the experiments were made. With heavier copper wires conversations have been successfully held over much longer distances.

Second Annual Endurance Test of the Long Island Automobile Club.

The second annual one-hundred-mile endurance test of the Long Island Automobile Club will be held over the club course, starting from Jamaica, L. I., at 10 A. M., on Saturday, April 26, 1902. Applications, entry blanks, information, etc., should be made to Mr. A. R. Pardington, Post Office Box 242, Brooklyn, N. Y.

Science Brevities

Dielectric Constant of Paraffines—By means of an electric wave method, says an abstract in the current number of the *Journal* of the Chemical Society, W. G. Hormell has found that the higher the melting point of the paraffine under observation the greater is the dielectric constant. As the wave-length diminishes, the dielectric constant increases. It is to be noted that Cauchy's formula for calculating the index of refraction for infinitely long waves gives results inconsistent with experiment.

The Passage of Electricity through Solutions of Electrolytes—More than forty years after his first determinations, says *Nature,* of the transport numbers of the ions in the passage of electricity through solutions of electrolytes, W. Hittorf describes, in the *Zeitschrift für physikalische Chemie,* some interesting experiments relating to the influence, exercised by the diaphragms separating the anode and cathode solutions, on the measured values of these transport numbers. When a porous clay diaphragm is used, the volume of the solution at the anode decreases in all cases investigated. When, however, an animal membrane separates the anode and cathode solutions, it is found that with solutions of the chlorides of potassium, ammonium and sodium, cataphoresis takes place in the direction of the current, while with dissolved chlorides of the alkaline earth metals and of cadmium, the cataphoric effect is in the opposite direction. In the latter case, the volume of the solution at the anode increases. At the animal membrane, apparently a separation of the original solution into a solution more concentrated and one more dilute takes place. This behavior of animal membranes results in considerable errors in the determination of transport numbers, and Hittorf is able to account for the deviations between the results obtained by himself in the late fifties and those more recently obtained by other investigators who have not made use of animal membranes in their experiments.

Visible Magnetic Tubes of Force—An arrangement by which cathode rays are made to trace out exactly the course of a magnetic tube of force in a vacuum tube brought into a magnetic field is described by H. Pellat in a recent issue of *Comptes Rendus.* Mr. Fournier D'Albe has abstracted this in the London *Electrician.* He finds that at certain pressures, and at certain high intensities of the magnetic field, the bundle of cathode rays issuing from a plane cathode takes the shape of the tube of force having the cathode for its cross-section. The tube of force is thus traced through the tube along its whole extent, since the luminosity, due to cathode or canal rays, proceeds from the cathode in both directions. The author points out that the cathode rays concerned in this phenomenon are different from those which undergo the ordinary magnetic deflection. He calls the former "flux A" and the latter "flux B." Flux A always proceeds from the cathode in the direction of the lines of force, whether those lines be normal, oblique or tangential to the surface of the cathode. It follows that the flux A is altogether independent of the sense of the field. This is not the case with the flux B, or the anode rays. The pressures within which the above phenomenon is observed range from 4 mm. to 0.004 mm. of mercury. The best display is obtained with the pressure of 0.5 mm. and a field of 3,000 units. A spectroscopic analysis of the violet rays concerned in the phenomenon shows only lines due to air, and none due to aluminum or its impurities.

Discharge from Glowing Platinum—The fact that glowing bodies discharge positive and negative electricity with unequal facility has been shown by many observers. The most detailed examination of this subject has been made by Elster and Geitel. They found that when a platinum wire was heated to a bright red heat, in an atmosphere of air or oxygen, at low pressure a cold metal plate in its neighborhood discharged negative electricity more readily than positive. If, however, a thin platinum wire or carbon filament is heated in an atmosphere of hydrogen at low pressure, the cold plate discharges positive electricity more readily than negative. A very simple means of obtaining strong surface ionization is to heat a platinum wire or plate to red heat by an electric current, and this has been employed by E. Rutherford and described in the *Electrician* (London) to test the validity of certain theoretical results when the ionization was confined mainly to the surface of one electrode. The author's theory indicates that the current between a positive platinum plate and another plate earthed through a galvanometer is independent of the intensity of the ionization, *i. e.,* of the temperature of the plate beyond a certain limit in value. Also, that the current is directly proportional to the square of the voltage between the plates; that it is directly proportional to the velocity of the ions, and inversely as the cube of the distance between the plates. The results show that none of these conclusions is strictly correct, but this is mainly due to a failure in realizing the theoretical conditions. The current falls off more rapidly than the inverse cube of the distance, and this is due to the heating of the platinum plate. As regards the velocity of the ions, that of the positive ions may vary within wide limits, and it increases with an increase of temperature of the gas. The velocity of the ions deduced from measures of the limiting current does not necessarily represent the average velocity, and is much less than the maximum velocity.

Ionization of Liquids by Radiation—P. Curie has made the important discovery that radium rays and Rœntgen rays are capable of imparting a conductivity to a liquid dielectric. The liquid is placed in a metallic vessel into which a tube of thin copper is plunged. These two metallic pieces serve as electrodes. The vessel is maintained at a positive potential by means of a battery of small accumulators, one pole of which is put to earth, while the tube is connected with an electrometer. This tube is also surrounded by a guard tube to prevent any current traversing the air. A small vessel containing a radium preparation can be placed at the bottom of the inner tube. The rays act upon the liquid after traversing the glass wall and the wall of the copper tube. When working with Rœntgen rays, the latter are made to enter through the bottom of the copper vessel containing the liquid. All liquid dielectrics show an increase of conductivity, says the London *Electrician,* by the action of both kinds of rays, but to prove this increase it is necessary that the original conductivity of the liquid should be small. Both classes of rays give effects of the same order of magnitude. As in the case of gases, the current remains proportional to the tension up to a certain limit, but this limit is much higher in the case of liquids than in the case of gases. It is, in fact, difficult to prove the existence of the saturation phenomena observed in the case of gases, as there is no sign of saturation below 450 volts. But if the ionization is lowered by employing much more feeble rays it is found that the proportionality between difference of potential and current is no longer maintained, and that some kind of saturation is indicated, as in the case of gases. Vaseline oil is much less sensible to the action of the rays than petroleum ether. Liquid air which has boiled for some time in the vessel is more sensitive to the rays than liquid air which has just been poured in. The conductivity due to the radiation is reduced by only ten per cent in passing from a temperature of 10 degrees to —17 degrees, and no effect whatever is produced by lowering the temperature of the radium preparation, even down to the temperature of liquid air.

An Induction Coil for X-Light Tubes and Wireless Telegraphy.

Being Note cxxxvii of Notes on X-Light.

By William Rollins.

SEVERAL years ago I designed an induction coil of value to experimenters because it could be easily, quickly and cheaply repaired. When the modern forms of electrolytic or Spottiswoode breaks came into use, it was found

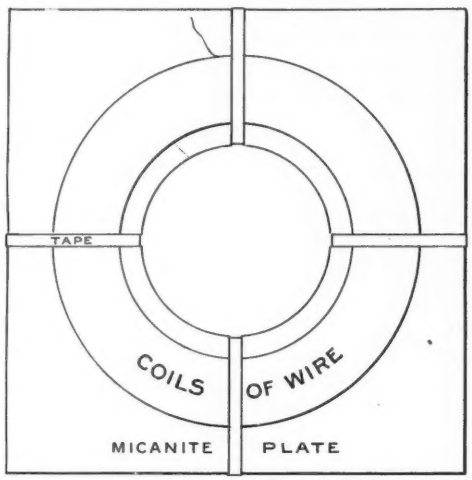


FIG. 1.—SIDE VIEW OF ONE SECTION OF 56-CENTIMETRE COIL. ONE-QUARTER SCALE.

that induction coils in general frequently broke down under the strain of the strong currents which these breaks made it practical to use. Therefore a short description of the coil was given in this journal for December 26, 1899. This coil differed in several ways from those in use. Instead of the usual hard rubber tube between the primary and secondary, one built up of many sheets of mica was used. These tubes, which can be obtained from the Micanite Company, now, in any size, are essential in induction coils which are expected to bear strong currents. The design of the secondary was new. The most practical induction coils commercially available have been made for years on the plan first proposed by Poggendorf before 1850. One of his coils, made by Siemens & Halske, was shown at the exhibition in London in 1851. Poggendorf's method consisted in winding the secondary in thin sections. In the coil mentioned the sections were separated by hard rubber. More recently makers have used paper, in consequence the coils have been less durable. All these sections have been fastened together into a solid mass by means of some insulating substances, like paraffine or wax. The defects of this method are well shown in the following quotation from a recent work—"Induction Coil and Coil-Making," by Allsop, in which Mr. Ward, who made for Mr. Apps the Polytechnic and Spottiswoode coils, speaks of repairs on the former.

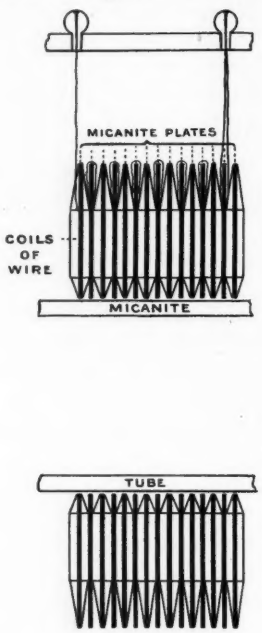


FIG. 2.—SECTION OF SECONDARY, ILLUSTRATING METHOD OF ARRANGING AND CONNECTING SECTIONS.

He says, "But owing to the parsimony of the directors of the Polytechnic they did not avail themselves of these two most necessary elements of success. They elected to move it themselves, and, owing to an enormous undue strain being put upon the primary tube in so doing, it was either cracked incipiently or so weakened that when they separated the terminals to a certain distance, through went a spark. This time the damage was repaired by Mr. Apps, which, I am sure, *everybody who knows anything of the almost insurmountable difficulties of withdrawing the old tube and putting in a new one without damaging the ponderous and delicate secondary will admit was a triumph of mechanical skill.*"

When we combine this difficulty with the greater one of repairing the secondary, it is very evident that such a construction is not well suited for coils that are to stand the strain of powerful currents. That the secondary needs some better method of construction is also shown by the fact that the second of the coils mentioned, the most famous coil yet constructed, now gives a spark not half the original length. Moreover, this shows that the methods in use for insulating the

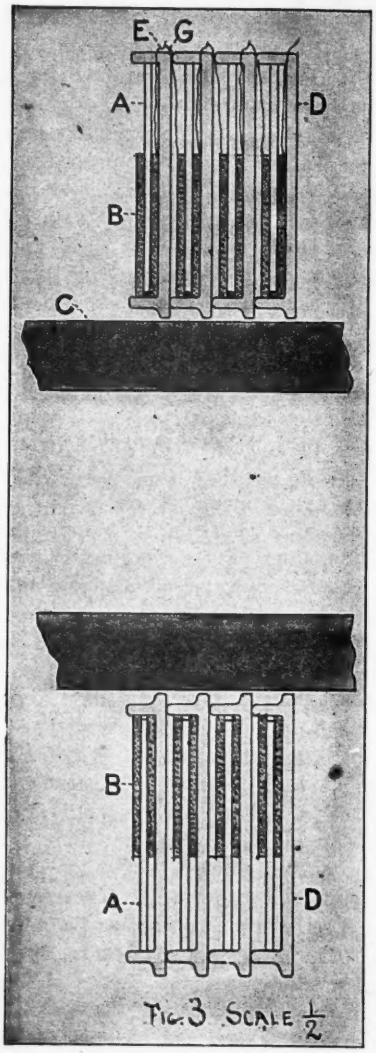


FIG. 3.—SECTION THROUGH SECONDARY SHOWING GLASS TRAYS. A, GLASS PLATE SEPARATING COILS OF ONE SECTION; B, COIL; C, MICANITE TUBE.

secondary, notwithstanding the great mass of insulating material employed, are not durable. They are also most inconvenient, for a coil should be so constructed that repairs can be made in a few minutes, by unskilled persons, without returning the coil to the makers. I therefore made the sections of the secondary entirely in-

dependent of each other, and perfectly free from the tube separating them from the primary. This made a simple matter to remove any injured section by drawing

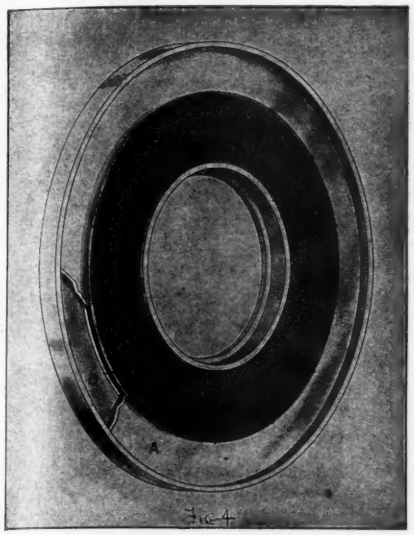


FIG. 4.—GLASS CELL OF SECONDARY. TWO COILS SHOWN EMBEDDED IN INSULATING GUM.

out the micanite tube enough to free the section. No insulation was used about the coils, except the glass plates to which they were attached in pairs, one plate and two coils forming a section. The sections were separated from each other by glass plates having holes in their centres only large enough to allow the micanite tube to pass through them. The holes in the glass plates to which the coils were tied were somewhat larger, to prevent a spark from jumping from one section to another over the intervening glass plate. When this coil was described in my paper, already mentioned, it was said that the method of construction was without value, for the insulation was so miserable the coil would soon break down. No one believed that such a simple method of insulation could be efficient. Since that time two other coils have been made, one of fifty-six, the other of seventy centimetres spark-length in which the same method of insulating the secondary was used. These coils have proved durable. If coils could be built without money I should have no hesitation in constructing one on this plan to give a spark several metres long.

Probably the last of the prophets died some time ago, but as it is possible that some who have criticised the insulation of this coil may belong to that class I give designs for two other methods of insulation which yet preserve the important features of complete independence of the sections of the secondary from each other and from the primary tube. First, however, I show a few figures of the original construction for a fifty-six-centimetre coil, a convenient size for all electro-therapeutic work that has been done by static machines. For X-light a larger coil should be used.

Fig. 1 illustrates one of the sections, consisting of two coils of double cotton-covered wire 0.13 millimetre in diameter (No. 36 Brown & Sharpe) attached on each side of a micanite plate twenty-eight centimetres in diameter. In the centre of the plate is a hole to allow the section to be strung on the micanite tube separating the primary from the secondary.

The weight of copper wire in each coil is 140 grammes, this weight including the

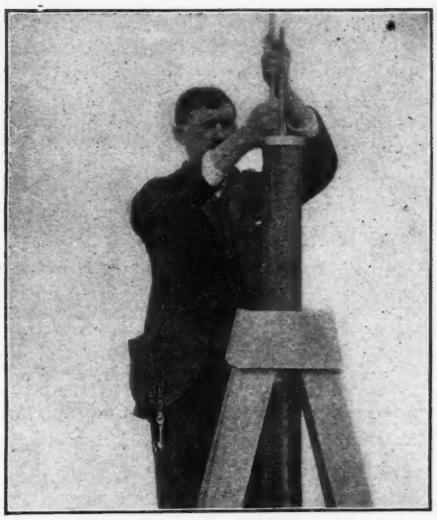


FIG. 5.—METHOD OF PACKING IRON WIRE CORE.

weight of the cotton covering. Each coil is four millimetres thick. The coils are attached to the plate by tape soaked in paraffine. Fig. 2 is a sectional view of the coil, showing the connections of the sections. The micanite tube was 112 millimetres long, with a bore of seven centimetres and walls two centimetres thick. The coils could have had a smaller diameter, but it was considered best to make them of such size that they could be used for a larger coil. The number of the coils was seventy-six. Figs. 3 and 4 show another method of insulating the sections. This was never carried out except in an experimental way, because I could not get the glass cells made. An experimenter can obtain but little satisfaction from the glass manufacturers, because he can not give orders for a thousand things all alike. I show the figures because the method is practical and simple.

Directions will now be given which will enable any one who has a reasonable amount of mechanical skill to construct a seventy-centimetre induction coil suitable for the powerful currents needed in wireless telegraphy and in X-light work.

THE PRIMARY.

This consists of a central rod of soft iron 220 centimetres long, one centimetre in diameter. It is provided with two cup-shaped flanges. One is fastened near one end by two lock nuts. The other can be clamped by a set screw in any position on the rod. The object of the flanges is to keep the rod central and to hold the ends of the surrounding wires in place. These wires are of the softest iron, each 168 centimetres long and one millimetre in diameter. They form a mass surrounding the rod. Outside the wires is a single layer of insulated copper wire whose diameter is 4.18 millimetres. (No. 6 Brown & Sharpe gauge.)

METHOD OF CONSTRUCTION.

A metal tube 168 centimetres long and 89 millimetres in internal diameter is used for packing the wires, as shown in Fig. 5. One of the cup-shaped flanges already mentioned serves to close one end of the tube to which it is temporarily fastened by a collar and set screws. To keep the other end of the rod central during the packing, an open flange with a central

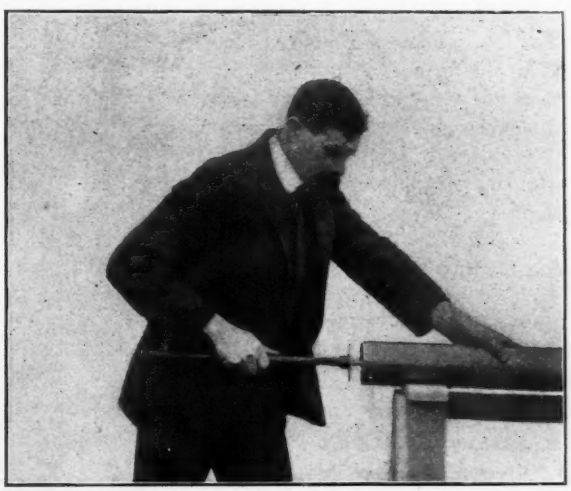


FIG. 6.—PUSHING OUT THE CORE FROM THE PACKING TUBE.

boss holding the rod is attached temporarily to the other end of the tube. When the wire is all firmly packed in the tube about the rod, it is necessary to push it out a little to begin the process of tying. As it is essential that all the wires be

pushed out evenly, a plunger exactly fitting the tube is used. Its handle is hollow to allow it to slide over the central rod.

FIG. 7.—TYING THE IRON CORE WIRES.

This is shown in Fig. 6. Fig. 7 illustrates the method of tying with strong cord. When one band of cord is attached, the wires are pushed out a little more to allow another band to be tied on, these operations being repeated until the whole core is out of the tube. The second cup-shaped flange is then put on and clamped against the ends of the wires, which are thus securely held between the flanges. The whole mass is then soaked in melted yellow ozokerite until no more bubbles come to the surface. This process prevents rusting.

After draining, the core is wrapped in strong manilla paper, put on diagonally, in strips fourteen centimetres wide, the paper being coated at the time with shellac in alcohol. As soon as one layer is dry another is put on, breaking joints. There should be seven of these layers. Except for the expense, it is better to pack the wire in a micanite tube, thus saving the time used in tying and wrapping. After the paper is dry a single layer of insulated copper wire is wound in a tight spiral around it. As I had no lathe long enough to mount the core, it was placed on the horse, one end of which is shown in Figs. 6 and 7. In this position one man can turn the core while the other is winding on the copper wire after fastening one end of it to the central rod, a hole in the check-nut being provided for this purpose. The second end of this wire, after the winding is completed, is brought out, as shown in Fig. 8, which is a general view of the primary. When the copper wire is all on, it is heavily coated with shellac in alcohol. After drying the whole primary is thickly covered with paraffine to make it slide easily in the micanite tube and further to insulate the spirals of copper wire. It will be observed, by looking at Fig. 8, that the central rod and wires form the return circuit for the 110-volt current which circulates through the copper spiral.

TUBE SEPARATING PRIMARY FROM SECONDARY.

This tube is of micanite. No other material is suitable. The length of the tube is two metres. Its walls are fifteen millimetres thick. The diameter of the hole is 105 millimetres. The tube is shown in Fig. 8.

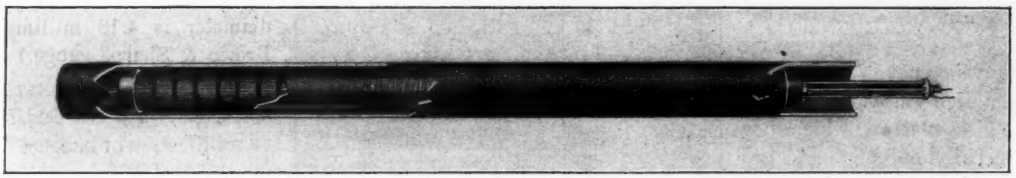


FIG. 8.—GENERAL VIEW OF PRIMARY OF 70-CENTIMETRE COIL, CUT AWAY TO SHOW INTERIOR.

SECONDARY.

This contains 126 coils of double-covered cotton wire, whose diameter is 0.10 millimetre. (No. 38 Brown & Sharpe.) Each coil is wound from a single piece of wire whose weight, including the cotton covering, is 154 grammes (five and one-half ounces). It is customary to have as many splices in the wire of a single section as happen to be in the wire when it comes from the maker, but as these splices in the wire are a cause of the coil breaking down under strong currents it is better to insist on having the wire in each section in a single piece. The internal diameter of each coil is sixteen centimetres. The thickness of each coil is four millimetres.

METHOD OF CONSTRUCTING THE SECONDARY.

It is customary to wind the coils of the secondary by hand. Allsop, in the work already mentioned, shows a section-winder operated in this way, and states that it is unnecessary, even if it were possible, to wind the wire in even layers, it must be allowed to find its own level.

However, as I like to see mechanical operations done in a workmanlike manner, a simple, automatic winding machine is illustrated and recommended

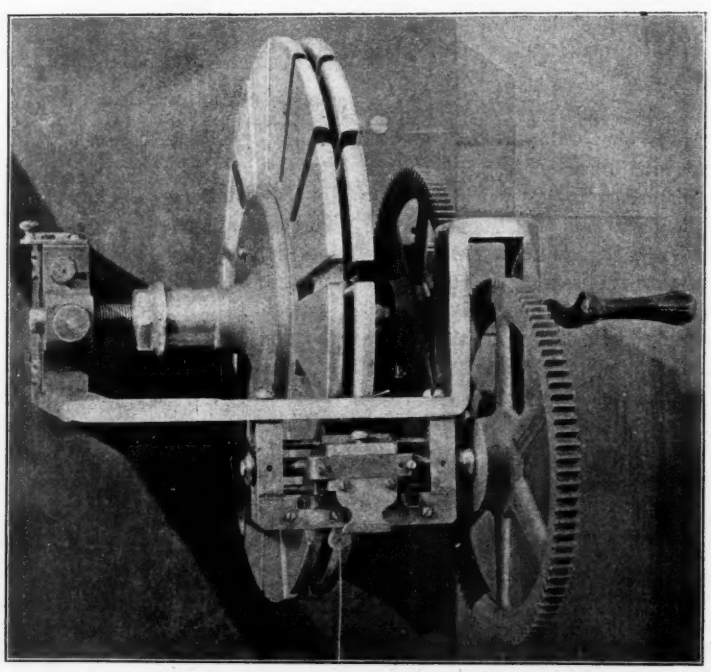
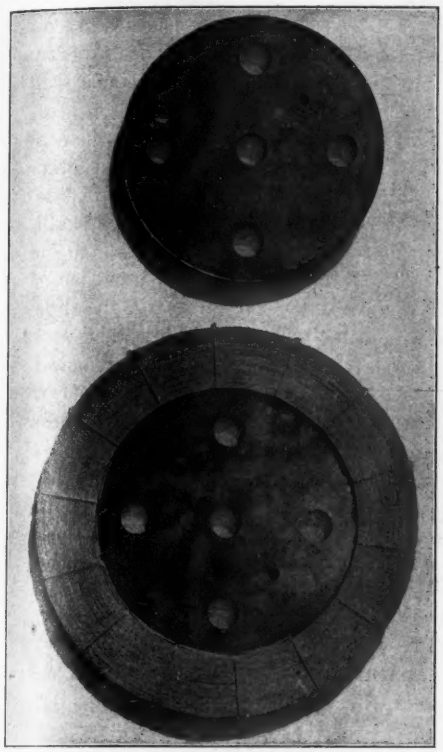


FIG. 9.—MACHINE FOR WINDING SECONDARY COILS.

which, winding the wire in even layers, puts more wire into the same space of strained ether, making the coil more efficient. This is a matter of much importance, as theory indicates and my experiments show. The machine (Fig. 9) was, as far as possible, made from forgings and such gears and parts as were commercially available, for in this way the cost of many patterns was saved. By means of a tilting carriage, bearing the eye through which the wire is fed to the machine, a to and fro motion is imparted to the wire. This motion is communicated to the carriage from a shaft with right and left threads, which come in contact alternately with similar threads on the ends of the carriage. The carriage is tilted automatically. The whole mechanism is so simple it can be readily understood from the half-tone illustration.



FIGS. 10 AND 14.—METAL FORM AND FRESHLY WOUND COIL SHOWING METHOD OF TYING.

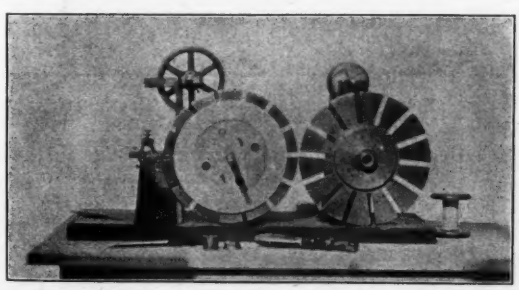


FIG. 13.—SHAFT OF WINDING MACHINE REMOVED FROM BEARINGS WITH ONE FLANGE TAKEN OFF TO SHOW COIL AND METAL FORM.

WINDING.

The coils are wound on sheet metal forms (Fig. 10), sixteen centimetres in diameter, with rims four millimetres wide. The width of a rim determines the thickness of a coil. There are a number of slots in the edge of the winding form to allow the thread to be inserted for tying the coil. One of the forms is placed in the winding machine, between the two flanges of cast iron with radiating slots, when it is desired to begin the winding of a coil. To ensure proper tension on the wire to wind it tightly, it is held in the hand as it is fed to the machine (Fig. 11). When enough wire (154 grammes) is wound on it is tied with linen shoe twine, No. 10 (Fig. 12). Fig. 13 shows one flange of the winding machine taken off, the shaft having been first removed from the machine. The figure also shows the disc on which the coil is wound, and a fresh-wound coil ready to be removed. See also Fig. 14. The coils are removed from the winding machine on the winding forms to ensure keeping their figures until they have been dipped in the insulating and stiffening mixture, after which they are rigid. When enough coils have been wound they are placed on a long-threaded arbor, each separated from the next by a disc of polished tinned iron. Both winding forms and separating discs are perforated with a number of holes to allow the insulating compound free of access. When enough coils are on the arbor they are firmly clamped between cast-iron discs turned true on their faces. Considerable pressure should be used to bring the coils firmly together. They are next dipped in a mixture of yellow ozokerite, three parts, and Carolina white rosin, one part. The mixture is melted in a water bath, made of galvanized sheet iron. It is important to use a water bath, for if the flame comes in contact with the trough containing the mixture this is sure to become carbonized after a time, and these fine particles of carbon get imbedded in the coils. As they are conductors they injure the insulation. The coils are to be kept in the insulating mixture at a temperature of 200 degrees Fahrenheit for thirty hours to ensure the removal of air and its replacement by the ozokerite. The process of dipping the coil is shown in Fig. 15. Only one group or one-third of the whole number is seen. In removing the coils from the bath they should be thoroughly drained, in an upright position, the mixture flowing out through the holes in the winding forms and separating discs. Afterward they are replaced in the position shown in the figure and kept there until they are perfectly cold. After that, when the flanges are lifted off, the coils can be cleaved from the separating discs and removed from the

FIG. 11.—WINDING A SECONDARY COIL.

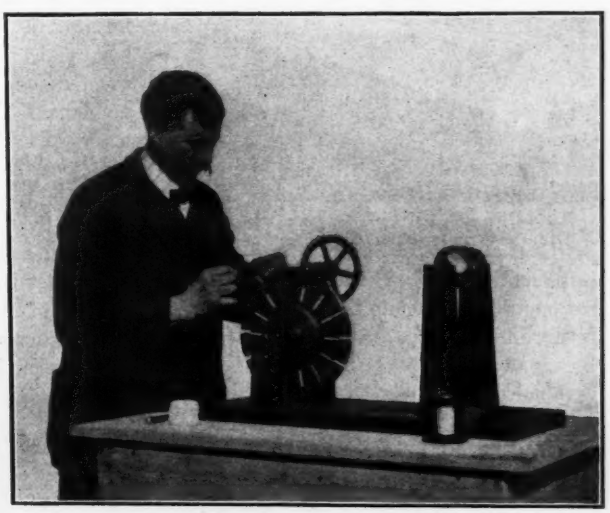


FIG. 12.—TYING A SECONDARY COIL AFTER WINDING.

winding forms. They are then ready for mounting. Fig. 16 shows the coils partly removed, and some coils with the winding forms taken out. A few of the coils are placed in an upright position to show their rigidity. They are very strong after dipping, as the insulating mixture is very tough.

MOUNTING THE COILS ON GLASS PLATES.

The mounting may be done with tape or by rings of ozokerite (Fig. 17) or by casting the ozokerite around them (Fig. 18).

BY RINGS OF OZOKERITE.

Second Method—Fig. 17 shows the elements of one section of the secondary, three glass plates, two coils and four rings of ozokerite. These are placed together, in the order shown in the figure, and pressed while slightly warm in an oven, forming a section, as seen in Fig. 19.

INSULATION BY CASTING.

Third Method—The coils and glass plates are fastened together about their edges; they are then warmed and the insulating mixture poured in through the funnel; the arrangement is shown in Fig. 18. The ozokerite enters at the bottom to allow the displaced air to escape. When the mixture is cold the funnel is removed and the gate trimmed smooth. The coil then looks as in Fig. 19, referred to in the second method. Under all conditions of our Boston climate the last two methods are unnecessary, but they are given because the coil thus made is especially valuable for wireless telegraphy, which is expected to find a large field on shipboard and in other damp positions, though under any atmospheric conditions of the temperature zone the first method is satisfactory. The last two methods are valuable where the coil is to be made as portable as possible and to be exposed to the risks of transportation, for the insulating mixture makes the sections capable of bearing quite rough usage.

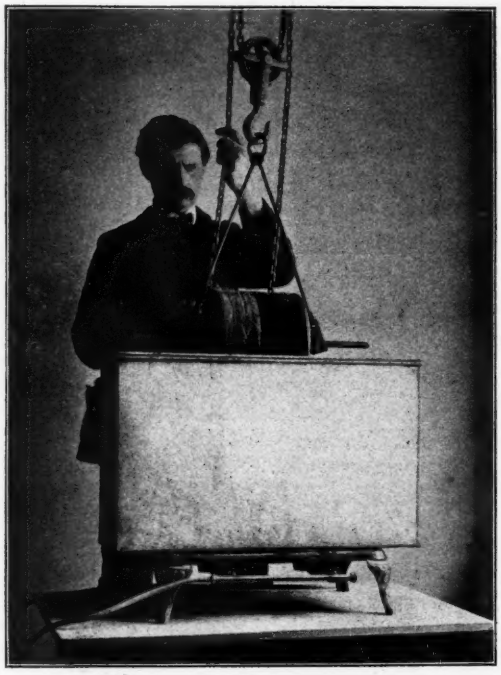


FIG. 15.—DIPPING ONE DIVISION OF THE SECONDARY.

CONNECTING THE COILS IN EACH SECTION.

This operation comes before insulating, but for convenience it is described later. The most difficult part of a coil to understand is the connections of the two coils forming a section. The best plan is to consider them as one coil split by accident. Then if they are so placed as to represent one coil, the inner ends of the wires being joined by twisting, they are in the proper relation to each other; that is, they form a continuous coil of wire in which the turns all go in the same direction. I have known of a coil which did not work well, because in one or more sections the turns of wire in the two half coils went in opposite directions. This is a mistake easily made.

FIG. 16.—DIPPING-ARBOR WITH ONE FLANGE REMOVED.

PACKING THE SECTIONS IN BOXES.

An inspection of Fig. 20 shows that the coil instead of being in one piece as usual is packed in three independent boxes. For a coil of this size this is an important feature, for the great weight of the coil makes it sometimes inconvenient to handle in one piece. The Leyden jars and the spark-gaps are attached to separate end pieces, which can be used at the ends of a single section if a small coil is wanted, or as shown in the figure, where a large one is required, but even with them, as in the figure, the coil may still be used as a small coil by a special provision to be mentioned later. All the boxes and the end pieces simply slide loosely on the micanite tube, and can be therefore easily removed for transportation. This is shown in Fig. 21. The centre of the top of each box is made of a strip of plate glass, which has holes for the insertion of brass balls, to which certain of the sections are attached. This arrangement has been fully described in note cxii. The plan enables the coil to be used either as a seven or a seventy-centimetre coil, or one of any size between, by simply moving the potential rods to the appropriate balls in the glass plates. Before connecting the sections together they are placed side by side in the wooden boxes, the slack being taken up by a rubber pad.

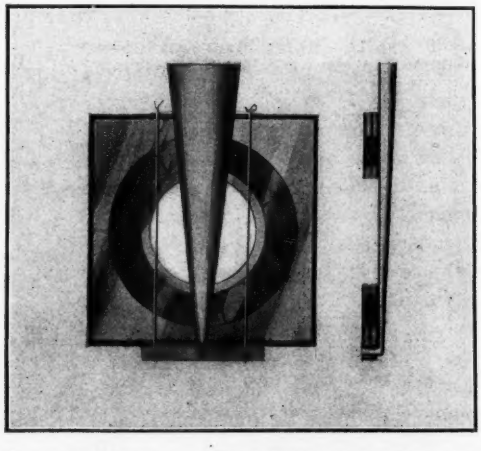


FIG. 18.—METHOD OF CASTING OZOKERITE AROUND ONE PAIR OF COILS.

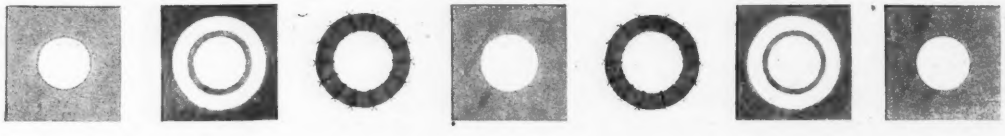


FIG. 17.—ELEMENTS OF ONE SECTION OF THE SECONDARY WINDING OF 70-CENTIMETRE COIL.

CONNECTING THE SECTIONS.

Begin at an end section. The outside wire is connected with an end ball in the glass plate. The second wire coming

from outside of a section is connected with the nearest outside wire of the next section, and so on through the box, except that when a section comes under a brass ball one of its outside wires is attached to the ball, as in the first outside wire of the next section. This is clearly shown in Fig. 2.

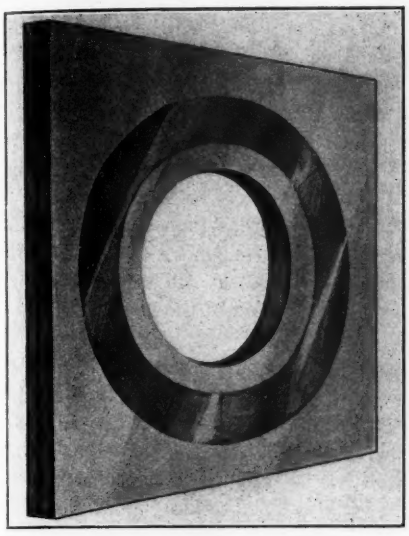


FIG. 19.—FINISHED SECTION OF SECONDARY.

CONNECTING THE BOXES.

After the boxes are placed side by side on the micanite tube the nearest balls are connected by metal loops to make a continuous wire through the whole secondary.

REMARKS.

It will be observed that the coil has much less wire in the secondary than the coils of which descriptions have been published. For example, the Polytechnic coil, already referred to, which in its best estate gave a spark no longer than this one, had about 275 kilogrammes of copper wire in the secondary, while in this coil there are but thirteen kilogrammes (28.6 pounds) of copper, for the wire including the cotton covering weighs but nineteen kilogrammes. The exact weight of the copper may vary slightly from the figures, though these were obtained from the makers of the wire. It will be seen that the weight of the copper in the secondary is only a twentieth of that in the Polytechnic. As the wire costs over $4 a kilogramme this is an important matter. There are several reasons why so small an amount of wire is required. First, the modern forms of the Spottiswoode or electrolytic breaks are more efficient than the breaks formerly used. Second, the secondaries of the coils have been unwisely placed in regard to the space of strained ether produced by the primary, therefore many turns of wire have been necessary to get the required spark length. I have immersed the secondary in more strongly strained ether by making the primary of what will be considered an excessive length and constructing the secondary in such a manner that very strong currents can be induced in it without risk of breaking it down. Now that the street current is available for exciting the primary of a coil our source of power is practically unlimited, therefore coils can be made much simpler than of yore provided they are made strong enough.

There is no condenser, because the coil is only intended for electrolytic breaks.

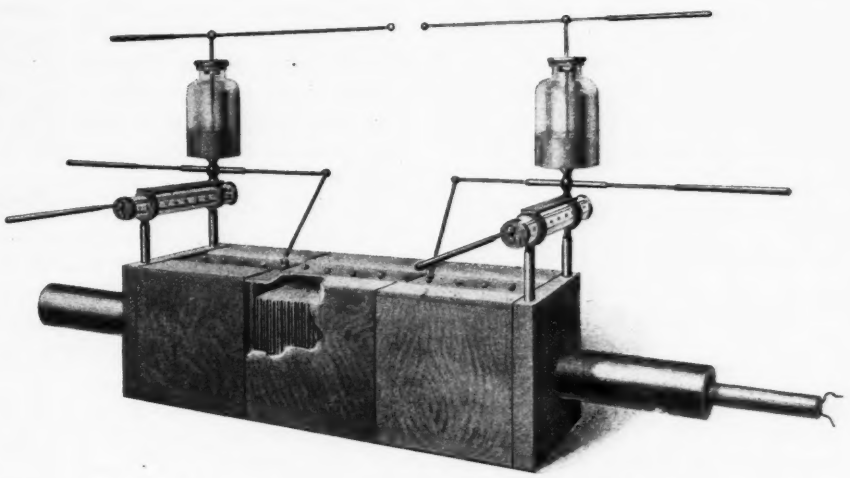


FIG. 20.—PERSPECTIVE VIEW OF 70-CENTIMETRE COIL.

The electrolytic break should be of a type which works regularly and in which the volume of current can be regulated by a conveniently placed handle which may be manipulated while the coil is in action.

To avoid repetition I have omitted several matters relating to the coil which were mentioned in note cxii, which should be read in connection with the present note. When a coil, of the power of this one, is used to excite an X-light tube with a strong current in the primary the tube needs to be proportioned to the current, therefore in a future note directions will be given for designing and constructing such a tube.

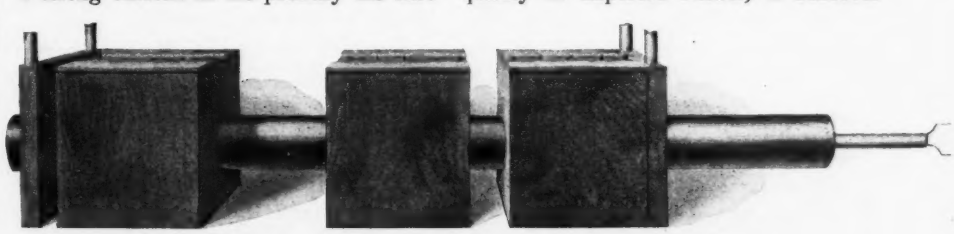


FIG. 21.—PERSPECTIVE VIEW OF 70-CENTIMETRE COIL SHOWING DIVISION BOXES SEPARATED.

The Adulteration of India-Rubber.

India-rubber, in its raw state, probably provides one of the most flagrant cases of adulteration on record. Pebbles placed in the centre of the "nigger head" variety to make weight, and the same on subsequent detection, by cutting the ball in two, being relegated to the two halves, such that the inspector's knife fails to reveal their presence, are familiar cases of fraud now almost played out. The latest system adopted by the native collectors applies more especially to fine Para rubber, and consists in a judicious mixture of farina flour with the caoutchouc while in a milky state. This flour is employed as food by the natives, and is frequently added in such quantities that its presence is immediately apparent on cutting into the mass. Smaller adulterations are readily rendered apparent by applying the usual iodine tests for starch; a solution of iodine, applied with a brush to the surface of the suspected rubber, causes the latter to turn a deep blue. So common has this species of adulteration become that a ten-per-cent admixture of farina flour is regarded by the importers as fair, usual quality. In view of this wholesale reduction in the quality of imported rubber, it behooves electrical buyers, such as cable-makers, to be very careful in their examination of consignments before accepting them as *bona fide*. The fault does not lie with the importers altogether, and possibly, if buyers combined to exclude such rubbers from the market, the evil might be remedied, or at least reduced.

Annual Report of the Directors of the American Telephone and Telegraph Company.

The annual report of the American Telephone and Telegraph Company has just been issued and makes very interesting reading. It is here reprinted in part:

PRESIDENT'S REPORT.

The increase in the number of subscribers to the exchanges of the companies which are licencees of this company was, for the year 1901, 219,767, exceeding by more than 50,000 the increase for the year 1900. The increase in the net output of instruments, including instruments for toll stations, was 573,194, or about thirty per cent, as against an increase of 372,-311 or twenty-three per cent, for the year 1900, the gain for 1901 being greater by more than 100,000 than that of any previous year. The increase in toll lines in 1901 was 9,372 miles of toll line and 108,666 miles of wire, the miles of toll line having more than doubled in six years, and the miles of toll-line wire having nearly doubled in three years.

The increase in the use of the Bell telephone is shown by the fact that, while in 1900 the daily average of toll connections was about 148,528, and that of exchange connections about 5,668,986, the daily average in 1901 of toll connections was about 187,378, and of exchange connections about 7,531,761, the total of both toll and exchange connections in the latter year reaching 7,719,139 per day.

In these latter figures are included the toll connections of the long-distance system owned and directly operated by this company. At the close of 1901 the long-distance system comprised 14,886.35 miles of pole line and cable, and 198,684.26 miles of wire, a gain during the year of 2,458.72 miles of pole line and cable and 31,273.87 miles of wire.

The long-distance lines extend from nearly all the important cities on the Atlantic seaboard throughout the country as far west as St. Paul, Minneapolis, Omaha, Kansas City, Little Rock and New Orleans, forming main lines over which telephonic communication between practically all of the exchange stations within the territorial limits above defined may be established.

The efficiency of these lines will be largely increased by the use of "loading coils," a new invention which has been acquired by this company, and which has already been put into use on overhead lines with satisfactory results. These loading coils are also likely to be of substantial value for the longer stretches of underground cable, and careful experiments in this direction are now under way.

The investment in line construction, equipment and supplies for the long-distance system up to December 31, 1901, was $19,116,209.40, an increase over the previous year of $2,964,188.68, while the gross revenue for 1901 shows an increase of 16.72 per cent over that of 1900, the increase for that year over 1899 having been 13.45 per cent. In considering this increase in gross revenue, it should be borne in mind that on July 1, 1901, a reduction of the initial message period from five minutes to three minutes was extended over the whole system with, of course, a proportionate reduction in rates.

The extensions of this long-distance system during the year 1901 were materially greater than in any previous year. This development must be continued to supply, so far as possible, the public demand for service of this character.

The high standard of construction which has been set by this company and its licencees has been fully maintained, and more underground conduit and cable and more aerial cable have been installed during the period 1901 than ever before in a like period.

More than half of the mileage of the exchange wires throughout the country is now underground.

The erection of new buildings, specially designed for telephone purposes, and the replacement of the old type of multiple switchboards by relay boards equipped with electric lamp signals and central-battery plant, to which reference was made in the last report, has continued throughout the year. At the present time practically all the principal exchanges, and many of those of minor importance, are furnished with the new equipment. This places them structurally on a permanent basis, enabling them to give proper service at a reasonable cost.

To meet the growth of business, and to provide for the necessary improvement and development of the plant, a corresponding outlay has been required. In new construction and in real estate this company and its licencees, during the year 1901, expended upward of $31,000,000, of which about $22,000,000 was upon exchanges, more than $7,250,000 upon toll lines, and about $1,750,000 upon real estate. The funds contributed by this company for this growth have, for the most part, been obtained by an issue during 1901 of $15,550,100 of new stock and of $5,000,000 of its collateral trust four per cent bonds. The investment is of a permanent character, is required for the assured future development of the business, and is one which brings in an immediate return. It is believed that there can be no question as to the wisdom of such expenditures, which must be continued as may be necessary to meet the demand of the public for telephone service.

That the system may be complete and of the greatest utility, it is necessary that as many persons as possible should be so connected to it as to be able to talk or be talked to by telephone. This is not only in the interest of the small user, but even more in that of the large user, whose advantage as a telephone subscriber is largely measured by the number of persons with whom he may be put into communication. It is the duty as well as for the interest of this company that proper facilities be supplied to the constantly increasing number seeking connection with the Bell system.

As a consequence of these outlays and of the great development of the plant, the value of the telephone service to the subscriber is largely increased. His service is better, and will continue to improve, and the number of those to whom he may talk, and the extent of territory over which he may talk, are substantially greater from year to year. At the end of 1901 there were nearly 900,000 telephone stations which could be connected to the long-distance system, and consequently to each other; a gain of about 180,000 for the year. At the end of 1898 there were only about 400,000 which could be so connected.

As the business has increased, and as economies made possible by improvements in apparatus and in methods of operating have been introduced, it has become practicable to offer telephone service at varying rates, some of them far below the maximum, thus satisfactorily accommodating those needing and desiring a telephone, but whose use of it is so small that they could not be expected to pay the rates which must be charged, and properly, to the larger users whose substantially greater demand for service can be complied with only at a greater cost to the telephone company. During the ten years last past the average price per telephone to the Bell exchange subscribers throughout the country has been reduced so that at the present time the subscriber on the average pays but two-thirds as much as ten years ago, although he has the advantage of much greater facilities and much improved service.

The introduction of schedules of measured service rates, enabling the user

to secure the service which he requires at rates determined by the number of messages for which he contracts, has been distinctly effective in enlarging the field for the telephone. This measured service-rate system, which is primarily based upon the extent of use of each particular telephone, distributes the charges and cost of service among the subscribers according to the amount of service in each case; a principle analogous to that upon which the charges for postal, express and telegraphic service are distributed. There can be no question as to the fairness and logical character of the principle. This method of charging is satisfactory to the subscribers, as well as to the telephone companies, and it is believed that it will ultimately become the standard method, at least in the larger exchanges. It is already very extensively employed.

Competition from telephone companies not associated with this company has existed for several years, and is likely to continue in some places for some time to come. While it has in some localities affected the licencees of this company disadvantageously, by reducing, for a time at least, the number of their subscribers and forcing them to meet competitive rates that are not based upon a proper recognition of the cost of doing the business or an adequate appreciation of the amount that should be set aside from earnings for maintenance, reconstruction and depreciation, the consequences of the competition to the business, as a whole, have not been of serious moment. The public in each community will determine for itself whether it is for its advantage that there should be two telephone exchanges serving one body of people. It would seem as if but one conclusion on this point was possible.

In any event the comprehensive character of the system of this company and its licencees, organized as the system is to afford uniform and adequate telephonic intercommunication throughout the country, and the intention and ability of the company and its licencees to give good service at fair rates, must ensure the permanency and prosperity of their business in the future as in the past.

Although not falling within the year 1901, it may be proper to say that, since the opening of the current year, the Western Telephone and Telegraph Company has been organized, and has taken over from the Erie Telegraph and Telephone Company the controlling interest in the Cleveland Telephone Company, the Wisconsin Telephone Company, the Northwestern Telephone Exchange Company, the Michigan Telephone Company and the Southwestern Telegraph and Telephone Company, and that a controlling interest in the Western company has been acquired by this company.

Appended hereto are a series of comparative statistics showing the development of the business of the company and its licencees; also a statement of the ledger balances of the company as of December 31, 1901, and a comparative statement of the earnings and expenses of the company for the years 1900 and 1901, also copies of the reports of the committee on treasurer's accounts of May 23, September 11 and November 30, 1901, and March 10, 1902.

For the directors,
FREDERICK P. FISH, President.

INSTRUMENTS IN THE HANDS OF LICENCEES, UNDER RENTAL.

THE FIGURES IN LOWER LINE SHOW INCREASE FROM YEAR TO YEAR.

Dec. 20, 1892.	Dec. 20, 1893.	Dec. 20, 1894.	Dec. 20, 1895.	Dec. 20, 1896.
552,720	566,491	582,506	674,976	772,627
40,313	13,771	16,015	92,470	97,651

Dec. 20, 1897.	Dec. 20, 1898.	Dec. 20, 1899.	Dec. 20, 1900.	Dec. 20, 1901.
919,121	1,124,846	1,580,101	1,952,412	2,525,606
146,494	205,725	455,255	372,311	573,194

TOLL CONNECTIONS.

The average daily number of toll connections is	187,378
Or a total per year of about	60,300,000
The toll revenue reported by all companies for the year 1901 was	$10,725,600*

EXCHANGES OF THE LICENCEE COMPANIES.

	Jan. 1, 1900.	Jan. 1, 1901.	Jan. 1, 1902.	Inc.
Exchanges	1,239	1,348	1,411	63
Branch Offices	1,187	1,427	1,594	167
Miles of Wire on Poles	509,036	627,897	823,193	195,296
Miles of Wire on Buildings	15,087	16,833	17,947	1,114
Miles of Wire Underground	489,250	705,269	883,679	178,410
Miles of Wire Submarine	3,404	4,203	4,200	3 (Dec.)
Total Miles of Wire	1,016,777	1,354,202	1,729,019	374,817
Total Circuits	422,620	508,262	592,467	84,205
Total Employés	25,741	32,837	40,864	8,027
Total Stations	632,946	800,680	1,020,647	219,767

EXCHANGE CONNECTIONS.

The estimated number of exchange connections daily in the United States, made up from actual count in most of the exchanges, is	7,531,761
Or a total per year of about	2,425,000,000

The number of daily calls per station varies in different exchanges from 1 to 20, the average throughout the United States being $7\frac{4}{10}$.

COMPARATIVE STATEMENT OF EARNINGS AND EXPENSES.

EARNINGS.

	1900.	1901.
Dividends	$3,846,821 67	$4,988,207 63
Rental of Instruments	2,427,037 52	2,647,906 64
Telephone Traffic	3,027,171 85	3,583,446 74
Real Estate	31,824 67	36,680 16
Interest	201,643 50	399,579 26
Miscellaneous	.....	995 51
	$9,534,499 21	$11,606,816 94

*Not including herein earnings of the American Telephone and Telegraph Company, which will be found in the comparative statement of revenue and expenses appended hereto.

EXPENSES.

	1900.	1901.
Expenses of Admin'tr'n	$746,359 48	$772,424 30
Legal Expenses	85,134 07	99,188 04
Interest and Taxes	1,376,199 94	1,276,559 20
Telephone Traffic	1,840,847 86	2,060,409 54
	$4,048,441 35	$4,208,531 08
Net Revenue	$5,486,057 86	$7,398,285 86
Dividends Paid	4,078,601 25	5,050,023 75
Balance	$1,407,456 61	$2,348,262 11
Carried to Reserves	$937,258 22	$1,377,650 74
Carried to Surplus	470,198 39	970,611 37
	$1,407,456 61	$2,348,262 11

WM. R. DRIVER, Treasurer.

Annual Report of the New York and New Jersey Telephone Company.

The annual report of the directors of the New York & New Jersey Telephone Company, showing the condition of business up to January 1, 1902, has just been published.

The treasurer's report shows earnings for the past year of $907,695.18, net, with a surplus on hand of $2,368,019.24. The dividends paid during the year were $616,285.50. The increase in net earnings over the previous year was $276,-029.93.

On December 31, 1901, the company was operating 42,130 telephone stations, a gain during the year of 6,954.

The earnings from the use of pay stations by the general public and from tolls for intercommunication between exchange areas were $1,591,275.12, a sum nearly equaling the amount earned from exchange service.

Several modifications of exchange rates have been put in force from time to time during the year, in each case effecting a reduction in the minimum rate charged to small users, and near the close of the year a complete revision of rate schedules was adopted, effecting a considerable lowering of rates to all classes of subscribers. While each of these reductions necessarily diminishes the company's profits from each individual station, the increase in the volume of business which it brings results in an increased profit, taking the business of the company as a whole.

Looking back over a period of ten years, it is found that the various modifications and reductions which have been made in the rate schedules have resulted in reducing the average annual rate received under subscribers' contracts for exchange service by $33.02 per station, during which period the number of stations operated has been increased from about 9,000 in 1891, to 42,130 at the end of 1901.

The management is giving constant study to this important question of exchange rates, and will undoubtedly recommend further modifications from time to time. It is its firm belief that ultimately the advantages of telephone service

should be brought within the reach of the most humble householder.

The new central office system has been installed at Elizabeth, N. J., during the year, and plans have now been completed for its installation at several other exchanges next in importance.

There has been expended in the enlargement of the company's plant during the past year $890,227.14, of which $73,-113.42 was for additional real estate.

The real estate investment of the company on December 31, 1901, stood at $1,-080,473.83. It is now estimated that a further appropriation for real estate, approximating in amount $450,000, will be required during the year 1902, a part of which will be expended in the enlargement of present buildings, and the balance for the acquirement of new property.

The largest single item in this estimate is for a new building of considerable size, to permanently house the "Prospect" central office in Brooklyn, and to afford accommodations for the working force employed in that part of the territory. New property is to be acquired and buildings erected at at least nine other points for the accommodation of exchanges of lesser importance, but where the business is growing so rapidly as to make it desirable they should be located in buildings owned by the company. The new capital stock sold to the stockholders in the early part of 1901 realized $1,875,000. Of this there remained unexpended at the close of the year $857,028.88.

"There has been little, if any, increase," says the report, "in the business of companies operating in competition in the company's territory. There have been no new installations of this character during the year, and those heretofore established have decreased rather than increased in importance."

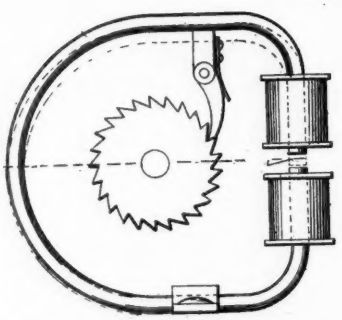
The officers of the company are: Charles F. Cutler, president; W. D. Sargent, vice-president; Waldron Hoppins, secretary; Henry Sanger Snow, treasurer; J. C. Reilly, general manager.

Annual Report of the Municipal Electricians.

The official report of the sixth annual convention of the International Association of Municipal Electricians, held at Niagara Falls, N. Y., September 2, 3 and 4, 1901, has been issued in the shape of a handsome souvenir book, six by nine, bound in a flexible red cloth cover. The proceedings are given in detail and numerous half-tone illustrations are distributed throughout its pages.

Electrical Patents

M. David Parret, of Neufchatel, Switzerland, has invented a novel electromagnetic apparatus designed especially for use in electric clocks. The invention in the present case resides in the employment of a stirrup of flexible material between two magnetic poles situated opposite one another and so related that as the electric circuit is alternately closed and opened these poles, or rather one of them, is caused to vibrate in the same manner as a contact-breaker oscillates. In one form of the invention the flexible stirrup is formed of round iron, the terminals of which are bent inwardly toward each other and carry exciter coils. One of the arms of this stirrup is fastened against



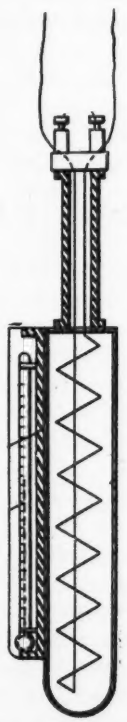
Novel Electromagnetic Apparatus.

movement upon a suitable support, while the other is free to vibrate. This free arm carries a pivoted pawl which engages with a ratchet wheel and partially revolves it upon the movement of the arm. It will, therefore, be readily seen that when the coils are excited the free arm will be drawn toward the fixed arm, consequently depressing the pawl and moving the ratchet wheel the distance of one tooth. This apparatus can be so arranged that, instead of the approaching movement actuating the ratchet wheel, the opposite or receding motion may be employed or both motions may be made use of for this purpose. In another form the inventor employs a complete loop, to the opposite sides of which are attached inwardly extending coacting poles. One of these poles is secured against movement and carries a fixed coil, the other being movable therein. The operation of the device is, of course, exactly the same as in the prior structure.

Mr. John A. Daly, of Washington, D. C., has just obtained a patent on a method of covering textile and porous materials with metal. The invention relates to metallizing textile fabrics and other porous articles for the purpose of producing ornamental metallic surfaces and substances. It is especially applicable to the metallization of lace and other ornamental and flexible fabrics, and by this process a metallic lace can be produced either rigid or flexible and having very many of the characteristics and much of the appearance of knitted or woven lace or other textiles. A textile fabric is used as a base. A knitted or netted cotton, linen or other fabric or lace may be used, but cotton is preferred. A solution made of pyroxylin, celluloid, xylonite or like compound dissolved in acetate of amyl, camphor or other solvent is first prepared, or rubber dissolved in chloroform or benzine may be used. This solution is made into a paint or creamy mass by the addition of finely powdered metal or bronze. The fabric or other porous material is thoroughly saturated with this solution, either by immersion therein or by the application of the solution to the fabric by means of a brush or otherwise. The fabric or material having been saturated with the solution is then partially dried. If a lace or netting, it should be stretched or spread out and the threads or meshes restored to normal or regular position. Excess of the compound may be removed by blowing or by centrifugal action. As pyroxylin gives considerable stiffness to the fabric, it is quite easy to spread out a lace or net to show to good advantage when saturated with such compound. The fabric or flexible textile substance having been covered by a conductor of electricity, consisting of finely powdered metal, is immersed in a proper chemical solution, and an electroplating attachment is made according to any approved formula. An electrodeposit of copper, nickel, silver or other metal capable of electrodeposition is then made on the fabric. If the coating or saturation has been properly done, a very even deposit is made, so that the original configuration of the lace or fabric is substantially preserved. A net can be covered with metal to give the appearance of an ornamental stamped or engraved metallic network, except that the electrodeposited net has much more the appearance of a knitted or woven textile material than has the usual metal construction, whether stamped or engraved. The solution of pyroxylin, celluloid, xylonite or like compound has a base of nitrated cellulose, and it is probable that the purposes of this invention nitrated cellulose compounds may be utilized in various ways. The solution having such a nitrated cellulose base, having been well mixed with the comminuted metal, carries the metal with it into the fibres of the material constituting the lace, net-

work, or knitted or netted fabric, and the subsequent electrodeposition of metal on a net or fabric so treated causes the electrodeposited metal to become incorporated with or firmly connected to the metal so enmeshed, producing a compound structure of lacework and metal or fabric and metal quite different from a metallic deposit on the surface of a material which has been covered with black lead or similar conducting material. For rigid materials, such as ornamental railings, window and other screens, gates, etc., a heavy electrometal deposit may be made on the textile base; but where flexibility is desired the fabric is but lightly coated with metal and may then be used as a trimming for garments or as a substitute for bullion, gold or silver lace, etc.

Herr Emil Kastner, residing in Berlin, has just devised a novel electric heater designed especially for heating liquid. He provides an outer water-proof casing



Electric Heating Device.

within which is arranged an electric wire or conductor of great resistance, the space around the conductor being preferably filled with non-conducting material that will transmit heat. To the upper part of the casing may be attached binding-posts to which may be connected a suitable source of electric energy, or a battery may be secured thereto. Upon the exterior of the casing is arranged a suitable thermometer. In use the casing is plunged in the liquid to be heated, and the current turned into the resistance or heating wire. A high temperature is thereby produced which is transmitted through the casing to the liquid in which the heater is immersed. The thermometer will, of course, indicate the temperature to which the same is raised.

Mr. George Westinghouse, of Pittsburgh, Pa., has just obtained control of a patent granted to Mr. Henry N. Potter, an American, residing in Gottingen, Germany, on a new insulating compound. The material has proven to be admirably suited as an electrical insulator, possessing qualities which particularly adapt it to be conveniently manufactured in the form of small insulating bodies for carrying circuit terminals and keeping them insulated from each other. One quality of this material, which especially adapts it for the purpose last mentioned, is that large numbers of pieces formed from it can be packed together and baked without danger of their becoming fixed together. In this respect and also in its ability to resist heat the material is superior to porcelain, while its insulating qualities are sufficiently high for ordinary electrical uses. The material consists, mainly, of soapstone or talc-powder mixed with water and some binder, such as tragacanth, dextrine or the like. The proportions in which the elements mentioned are usually mixed are: One hundred parts soapstone or talc-powder, fifteen parts tragacanth and thirty-five to forty-five parts water. These elements are first mixed to form a paste or dough, and are then moulded or otherwise formed into the desired shapes, after which they are dried, and when the drying process is complete they are either baked separately or packed together and subjected to the baking process. The advantage is that they can safely be packed in this way and that there is little or no tendency for the pieces to become attached to each other during the baking. The insulating compound above described is well adapted after its final treatment to resist the effects of intense heat. The compound is exceedingly light in weight and possesses the advantage due to such lightness. Two to four parts of magnesium chloride or a magnesium nitrate may be added to the mixture. Should the insulating material be designed for use in places where there is little or no danger of exposure to great heat, there is sometimes added to the mixture first described about five to fifteen per cent of water-glass. This addition has the effect of making the compound much harder and mechanically considerably stronger. For many uses the compound containing water-glass would be preferable to one which lacked that element. The inventor has given to the compound, whether containing the water-glass or not, the name "talcite."

Korean View of the Electric Car.

When the electric-car service was first opened in Korea it furnished a most perplexing theme to the minds of the Koreans for they could not see how the electric cars could move along without any horse or any steam engine to pull it. Many months passed without any solution being found by these doubtful Koreans. During these months there was no rainfall in Seoul, and the fact at once brought a happy idea into the Korean mind. Koreans believe that rain is produced only by rain dragons that live in the sky. Now, in view of the drought, these dragons, the Koreans argued, must have been captured by the enterprising Americans, whose intention was to cause them to exhale the steam by means of which the electric cars are driven on. In support of their argument they pointed to the blue sparks that are often seen in the engine room of the electric railway company and said that the flames were those which the dragons vomited in the agony of being compelled to manufacture the steam. This solution of the electric-car mystery and of the drought was enthusiastically endorsed by the ignorant populace of Korea. It then came to pass that the enraged natives wreaked their vengeance on the electric cars with terrible vehemence. The motormen were attacked and injured, the rails were torn up, and the cars were destroyed. Then, taught by these costly experiences, an engineer of the electric car company contrived a cunning method to outwit these Koreans. One day, a short time ago, he caught one of these riotous people in the electric car and driving him into the engine room imprisoned him there all the night. There was the formidable mechanism of electricity, but no dragon. The sight was a complete disillusionment for the Korean. He spread the report among the other superstitious people and hence they are perfectly quiet on this head at present.—*Japan Weekly Times.*

King Solomon was right in a good many things. It certainly begins to appear as if nothing is entirely new. On the occasion of the seventy-second annual festival of the school children of Boston, held in Music Hall of that city on July 28, 1865, Wendell Phillips was the orator. Among other things he said, "I expect, if I live forty years, to see a telegraph that will send messages without wires both ways at the same time." The orator did not live the forty years, but wireless telegraphy has yet three years more in which to fulfill completely his prophecy and expectation.

ELECTRIC MINING NOTES.

ELECTRIC POWER AT COLLIERIES IN EUROPE.

Mining engineers are rapidly arriving at the opinion that electricity is the most economical agent for distribution of power about collieries in Europe. In Belgium, in the Charleroi district, a group of three collieries, extending a distance about four and a half miles from the power station, are supplied with the principal portion of the power they require by means of three-phase electric currents. At the power station there are two 600-horse-power Vonde-Kerchove engines fitted with Corliss valves, directly coupled to two 400-kilowatt, three-phase alternators, furnishing current at 3,000 volts. The current is distributed to the mines by three bare copper wires, carried on iron poles, insulated wires being used for the mine shafts and for underground. The full 3,000 volts is taken to the motors. At the Gilly shaft, about 300 yards from the power station, two pumps work at the pit bottom, each of 200 horse-power, directly coupled to three-phase motors, receiving current at 3,000 volts. At the Appaume Ransart shaft, about two miles further away, there are two pumps, one taking 130 horse-power and the other taking 200 horse-power, both coupled directly to 3,000-volt, three-phase motors. A number of smaller motors are also connected to the same service, and current is taken to another mine two miles farther away.

THE PRESSURES USED IN MINES IN GREAT BRITAIN AND ON THE CONTINENT.

In great Britain the pressure almost universally employed in mining work is 500 volts. It is varied by some mines, using 550 volts at the generator and 500 volts at the motors, and again by others using 450 or 480 volts at the generator and some smaller pressure at the motors, but these are only variations arranged by different manufacturers to suit the convenience of their special designs. There are evident signs, however, that the pressures employed in British collieries will shortly be raised to 1,000 and 2,000 volts. The areas over which distribution is required are getting larger and larger, while the quantities of power to be distributed are also getting larger and larger, and the cable problem is assuming awkward proportions. Already one firm, which is carrying out one of the largest installations that has been carried out in this country—where a portion of the power is required for a colliery some distance from the power station—is using 2,000 volts for this portion of the work. The main generating plant is to run at 550 volts, and is to supply the colliery in its immediate neighborhood at that pressure. For the distant colliery a step-up transformer, raising the pressure to 2,000 volts, is to be employed, and the pressure is again to be stepped down to 500 volts or 550 volts on arrival at the distant colliery. In another case, where a large area has to be covered, the engineer who is in charge of the work is contemplating the use of 2,000 volts, transforming down inside the mine. On the Continent, on the other hand, engineers have gone boldly to 3,000 volts, as indicated in a previous note, and there is no stepping up nor stepping down. This difference marks the difference in thought between Continental electrical engineers and British electrical engineers. The recent proceedings before the arbitrator appointed by the Board of Trade, the official body which rules railways and other similar things, to decide whether 500-volt continuous current or 3,000-volt, three-phase alternating current should be used for the working of the old Underground Railway, is in accordance with this. And it is also in accordance with British caution that the 500-volt service has won the day.

THE MINES UNDER LONDON.

The tube railways which are now running under London, and which are so deservedly popular, are virtually mines. Pits are sunk to the required depth at different points, those for preference where the stations are to be when the railway is running. Miners are employed in sinking the pits and in driving the headings. To crown all the smell which emanates from the stations of the lower level tube rail ways is exactly similar to the smell that is so familiar to mining men. The only difference between the tubes and the roads of an ordinary mine is the tubes are made permanent just as the bottom of the shaft of a coal mine is, while the roads of a coal mine are more or less temporary supported by timber and occasionally by steel props and girders only till the coal to which they give access has been brought to the surface.

POLYPHASE VS. CONTINUOUS CURRENT FOR MINING WORK.

Polyphase plant appears to be slowly making its way into British collieries, and also in those on the Continent of Europe. In the United Kingdom the pressure has, up to the present, been kept at the orthodox 500 volts, and even in those cases where it is in contemplation to use 2,000 volts for transmission to a distance there is no intention of using any higher pressure than 500 volts in the mine itself. There is no doubt, however, that this rule will have to go the way of other rules that have gone before. There was no special reason for using a pressure of 500 volts at first, except that this was the pressure at which American engineers were running their electric trams. But as in everything British the figure once set has appeared to be endowed with the permanence of the laws of the Medes and Persians. Distribution within the mines themselves, however, will necessitate the use of higher pressures unless very heavy cables are to be employed. For the past two years polyphase plant has been more or less on its trial. It was thought to be somewhat of a toy, but it has stood all tests so far very well, and has proved itself to be adapted to any kind of work there is to be done about a colliery in the power line. Polyphase motors have been applied to such widely differing problems as driving pumps, fans, hauling engines, where the haulage system was main and tail rope, and where endless rope was employed, to driving air compressors underground, to driving coal-cutting machines of every known type, and the numerous little jobs about a colliery, and it has rendered a good account of itself in all of them.

MAIN AND TAIL HAULAGE AND ENDLESS ROPE HAULAGE.

To appreciate the trial out of which polyphase motors have come triumphant, it is necessary to understand what is required from a motor driving the different haulage systems. Haulage is required in a mine to drag the trams, as they are called, the small wagons into which the coal is filled when it is cut, from the working face of the coal to the pit bottom, or the mouth of the level slant, where that is the method of working. On the main and tail system, a number of trams are hitched together, forming a train and dragged out from the working face to the shaft, at considerable speed. With the endless rope system, the rope, which is endless, it may be two ropes connected together in fact, is always traveling, one rope or one portion of the rope going toward the face and the other toward the shaft bottom, but always at a very slow speed. The trams are hitched on to the rope at intervals, the full trams to one rope, and the empty trams to the other, so that there is a constant procession of full trams proceeding to the shaft, and a similar procession of empty trams proceeding to the working face. It will be understood that the strains upon the rope and the motor with main and tail haulage are very much more severe than with

the endless rope, and this is very much increased by the fact that many colliery roads resemble a switch-back railway in the difference of the levels over which the trams have to be hauled. For a short distance the load will be coming up hill, then it will be coming down hill, actually assisting the rope that is dragging it, then it may be level for a short distance and so on. This is unavoidable in many collieries. Many mining engineers have hesitated to entrust electric motors with main and tail haulage for this reason, and in one of the most advanced collieries in Scotland, while electric motors are allowed to work the endless rope which takes the bulk of the coal trams to the shaft bottom, the main and tail and single haulage systems which feed the endless rope are worked by rafters driven by compressed air. In other cases, however, shunt-wound motors and polyphase motors have been trusted with main and tail work and have done it well, and they have assisted the power distribution by returning energy to the system when the load they were hauling was going down hill. The polyphase system is gaining ground where the distance to be distributed over is large, owing again to the greater convenience for distributing the power.

The American Electrochemical Society.

The meeting for the organization of the American Electrochemical Society, which will be held in Philadelphia on April 3, 4 and 5, promises to be very largely attended, and already no less than 312 promises of prospective members have been secured. This, and the fact that many of the replies received to the invitations to be present were enthusiastic and the large number of papers already received, show that the society is needed and that electrochemists do not consider existing societies to meet their requirements.

Besides the papers and the programme already announced in the ELECTRICAL REVIEW two others have been received, one from Mr. Titus Ulke, of Sault Ste Marie, Ontario, on "The Electrolytic Refining of Composite Metals," and the other by Mr. Edward R. Taylor, of Penn Yan, N. Y., on "The Manufacture of Carbon Bisulphide in the Electric Furnace."

The formation of the society is the outgrowth of a meeting held in Philadelphia on November 1 in response to a letter of invitation sent by Messrs. Hering, Reed, Richards, Roeber, Sadtler and Wahl. In response to this letter a number of gentlemen met and planned the forthcoming meeting. Committees were formed for various purposes and the name of the society was selected. It was decided that the dues should not exceed $5 per year and that meetings should be held from time to time in different cities.

"AIRGRAMS."

TO THE EDITOR OF THE ELECTRICAL REVIEW:

I would suggest the simple coined words of "airgram" for a wireless telegraph message, "airgraph" for the system of wireless telegraphy, "airphone" for the wireless telephone. It would be easy and intelligible to say that an airgram had been received by the "Tesla airgraph" or "Marconi airgraph," or any other system. The word "airphone" is also descriptive and comprehensive.

WILLIAM BERRI.

Brooklyn, February 5.

[*From the San Francisco Chronicle*]

A new word is being sought to express the meaning of wireless telegraphy and which will commend itself for general adoption. The following have been suggested to the New York ELECTRICAL REVIEW: "Atmography," "etherography," "conigraphy," "syntography" and "ethergraphy." As neither one seems to exactly fit the necessities of the case, "airgraph," "airgraphy" and "airgram" are suggested by the *Chronicle* as shorter, simpler and plainer words to convey a specific idea of the system and its work.

The ELECTRICAL REVIEW has already received a considerable number of suggestions for a name for what is now commonly called "wireless telegraphy." For example, Mr. Frank B. Knight suggests "ethergraphy" as an improvement upon Mr. Charles Sidney Smith's suggestion of "etherography." Mr. J. Franklin Stevens is responsible for the suggestion of the word "syntograph." Mr. G. C. Dietz has given us "atmography." The London *Times*, in a recent issue, spoke of a "Marconigram" having been sent, while Mr. Jarvis B. Edson has favored us with the suggestion "conigraph." All of these names indicate at least one fact—that no satisfactory name yet exists. Since it seems certain that wireless telegraphy will meet with a considerable use, at sea if not on land, the necessity for a word which shall clearly and distinctly define and describe this method of signaling is needed. The word, of course, should be of an international character; that is, it ought to be one that could be spoken without difficulty by the peoples of continental Europe and which would fit in with the orthography of their languages. Naturally, good taste indicates that the word should not be of hybrid origin, but as in the case of such newly coined words as "telegraph," "telephone" and "microscope" should be taken from the Greek or the Latin, while it should be at the same time reasonably short and tolerably euphonious. The ELECTRICAL REVIEW is pleased to receive and publish all suggestions for this name sent in. No prize is offered for the successful name, because nothing but the test of time and use can determine which will finally separate itself from its fellows and be accepted of all men. The successful inventor of such a name will have at least the satisfaction of having been of use to his craft.

Annual Meeting of the American Telephone and Telegraph Company.

The annual meeting of the stockholders of the American Telephone and Telegraph Company was held at the offices of the company, 15 Dey street, New York, on Tuesday of this week. President Frederick P. Fish presided.

The annual report, which is published elsewhere in this issue, was presented. Pursuant to an amendment of the by-laws of the company the number of the board of directors was increased to eighteen, and the following-named gentlemen were elected directors for the ensuing year: Charles W. Amory, George F. Baker, Francis Blake, Charles P. Bowditch, George L. Bradley, John H. Cahill, Alexander Cochrane, T. Jefferson Coolidge, Jr., Frederick P. Fish, J. Malcolm Forbes, Henry S. Howe, Charles Eustis Hubbard, Charles E. Perkins, Thomas Sanders, Nathaniel Thayer, Theodore N. Vail, John I. Waterbury, Moses Williams.

Among the new names are Mr. George F. Baker, president of the First National Bank of New York; Mr. Theodore N. Vail and Mr. John I. Waterbury.

Wireless Messages Intercepted.

The naval correspondent of the London *Globe* has reported that on her recent cruise along the Irish coast the battleship Revenge was fitted with wireless telegraph apparatus, and received a number of private messages which were passing between the mail steamers and the shore. According to the New York *Times* this correspondent understands that the Admiralty proposes to make an attempt to intercept Marconigrams from an experimental station across the Atlantic, with a view to determining whether Signor Marconi has perfected his syntonic system.

INDUSTRIAL SECTION.

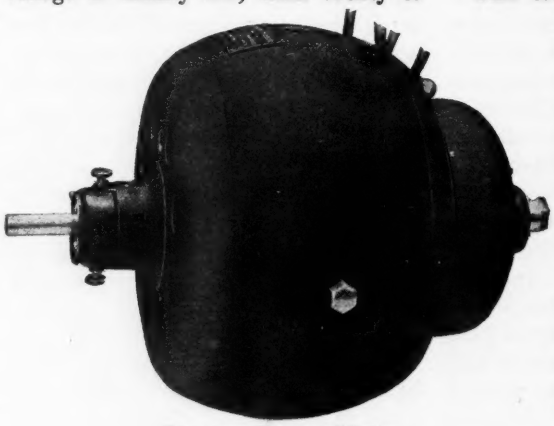
ILLUSTRATED DESCRIPTIONS OF NEW AND STANDARD ELECTRICAL AND MECHANICAL APPARATUS.

Launch Motors.

Navigation is one of the latest fields to be invaded by electricity, and now small launches and even rowboats are being driven by electric motors in an entirely satisfactory manner. In the accompanying illustration is shown a half-horsepower motor, which is one of a line constructed especially for launch work. As will be observed, the motor is entirely enclosed, being practically moisture-proof. If the motor is well protected or is to be used in fresh water, the weight is materially decreased by the use of aluminum in parts where other metals are not necessary for electrical or magnetic purposes, although, if the motor is likely to be exposed to the salt water, brass or iron fittings are recommended because of the corrosive action of the salt water upon the aluminum. In the latter case the finished parts of the machine are copper-plated for the same reason. The shape of the frame is such that two equal paths are provided for the magnetic flux, one on either side of the armature, a design which allows of great compactness.

As the voltage is low the current is necessarily proportionately high, making the design of the brush-holder a feature of great importance. The brush-holder used with these motors is of the box type with parallel feed, making it possible to run the motor for a long period of time without any attention to the brushes. A special form of brush is used consisting of stratifications of woven copper gauze and carbon, the outside layers being of the latter substance with a heavy copper plate. In this way are secured the advantages of the high conductivity of the copper and the wearing qualities of the carbon, the latter also preventing the copper gauze from spreading out and sticking in the holder. A continuous metallic circuit is maintained between the brush and the holder, so that no sliding or imperfect contacts are required to carry current. This makes an extremely efficient and satisfactory brush arrangement for work of this kind, allowing long wear with minimum attention and making heat losses, due to the flow of the current, insignificant.

The machines are economical in operation. The speed is low, 1,000 revolutions per minute, and as they are series-wound, field energy only in proportion to the load is used, thus modifying two of the most important sources of waste, namely, friction and heat losses in the windings. The voltage is usually low, from twenty to



ENCLOSED LAUNCH MOTOR.

forty being ample in most cases, so that there is no possible chance of injury to the operator. The motor is usually supported in the stern of the boat by means of heavy braces which are bolted to the body of the motor. This line of machines is being manufactured by the Holtzer-Cabot Electric Company, of Boston, Mass.

Staple-Driver for Electricians.

In the accompanying illustration is shown a handy little tool which will do away with much of the damage and defacement which more or less accompanies the use of a hammer in driving staples

ELECTRICIANS' STAPLE-DRIVER.

in wiring work. This tool is so constructed that it will hold several sizes of staples, retain them in the guide when inserted and, it is claimed, will drive them straight and true in any place where one hand can reach, and in places where it is impossible to properly insert them by the use of a hammer.

This tool is manufactured by G. A. McIntire & Company, Stamford, Ct., who claim that there is no possibility of injuring insulated wires as in the ordinary method. Staples may be forced into plaster without breakage and without loosening it from laths.

The plunger is made of tool steel, hardened, drawn and magnetized. The tube and guide are in one piece of heavy-gauge brass, half hard and swaged to shape.

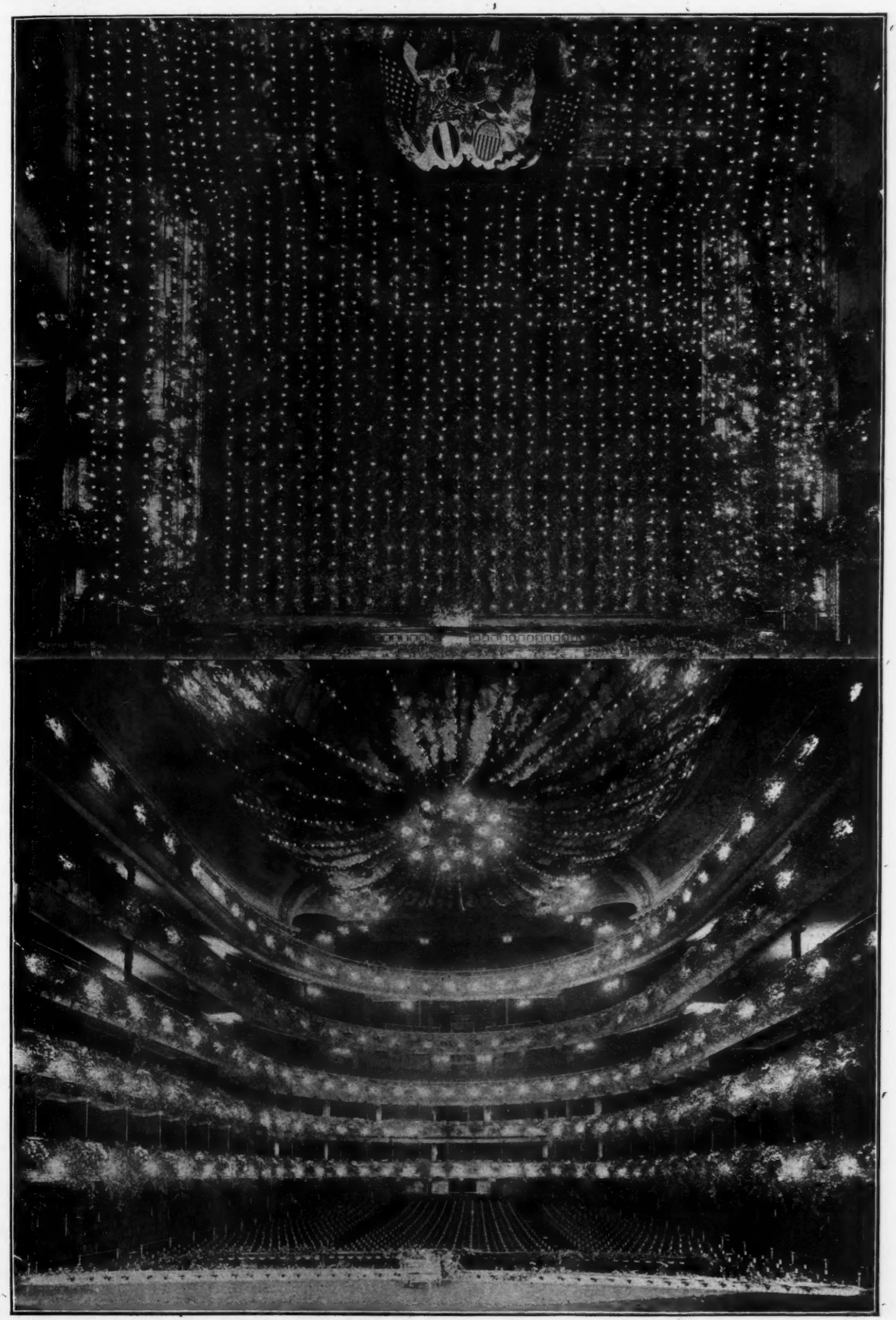
The Decorative Effects of Small Incandescent Lamps.

The large engraving on the opposite page gives an idea of the extent to which the manipulation of small incandescent lamps was carried in producing brilliant and wonderful effects in the decorations at the Metropolitan Opera House during the fête given in honor of the visit to New York city, and incidentally to the opera house, of Prince Henry of Prussia.

The upper part of the picture represents the appearance when a specially constructed drop-curtain had been lowered and the current turned on in the whole mass of lights. In the curtain alone there were 3,000 small lamps, another 3,000 lamps being distributed in the proscenium arch and the column draperies. This was intertwined with smilax, the white and the green of the lamps producing a bewildering display of color.

From the lower picture only a slight idea can be conceived of the beauty of the ceiling decoration in which 1,500 lamps were used, the ends of the streamers being caught up at a special panel situated above the ceiling at the middle chandelier, the other ends being fastened to the sides of the building. An additional feature was the use of 1,000 lamps in decorating the lobby and royal box.

This installation, comprising 8,500 small lamps, and using some 1,500 amperes of current, was constructed in remarkably short time and in the face of a great many mechanical difficulties. The "Elblight" system of twin cables, manufactured by the National Electric Improvement Company, New York city, was used throughout this decoration with singular success.



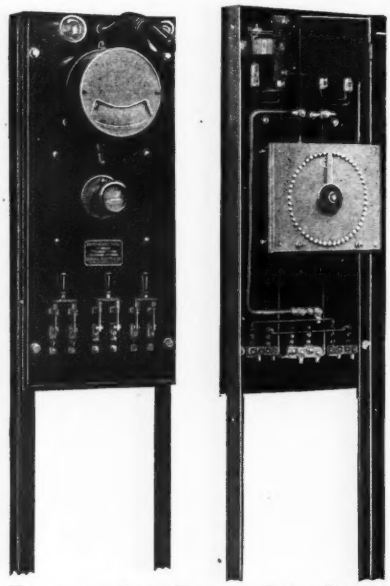
1.—The Drop Curtain of Smilax, White and Green Lamps, and the Proscenium Decorations.
2.—General View of Decorated Auditorium and Ceiling from the Stage.

THE ELECTRICAL DECORATIONS AT THE METROPOLITAN OPERA HOUSE, NEW YORK CITY, IN HONOR OF PRINCE HENRY OF PRUSSIA.

[Photographs Copyright by Pach Bros., N. Y.]

Small-Plant Switchboards.

The continued increase in the use of electricity, especially in small units for lighting and power, has brought about an extensive demand for switchboards to be used in connection with such small installations. The design and construction of such boards to meet the special requirements of each plant have proven not only expensive but very materially inconvenient, on account of the time required. For such work, however, the General Electric Company now offers a complete line of standard small-plant switchboards manufactured in a variety of capacities. The designs include a complete series of combination generator and feeder panels for low-potential, direct-current, small-



FRONT AND BACK VIEW OF SMALL-PLANT SWITCHBOARD.

plant service. Each of these panels is a complete standard switchboard and is not intended for combination with other panels.

The great care used in determining just what features should be embodied in panels of this type, in order to make them serviceable in the largest number of cases, has resulted in a design embodying a standard of finish and efficiency which can be produced at a reasonable figure and in such quantities that orders may be promptly filled. These small-plant switchboards are uniformly made to provide for one generator and two feeder circuits. The material used in the construction of these switchboards is black enameled slate, one and one-half inches thick, especially selected with reference to freedom from metallic or other impurities likely to impair its insulating qualities. After being baked perfectly dry, the slate is covered with enamel, each layer being baked on and rubbed down, the final hand polish resulting in a hard brilliant surface.

The height of the slate panel is thirty-six inches for all capacities, the width varying from sixteen inches to twenty inches, depending upon the capacity. All exposed metal parts on the front of the board, except live copper, have black oxidized finish.

Two methods of support are manufactured, either of which is supplied according to the requirements. One is known as the angle-iron support; the other, the bracket support. In the first method, the panel is supported on angle irons forty inches from the floor, the angle iron being provided with turnbuckles and clevises for making wall attachment. In the second method the panels are secured to the wall by bracket supports independent of the floor.

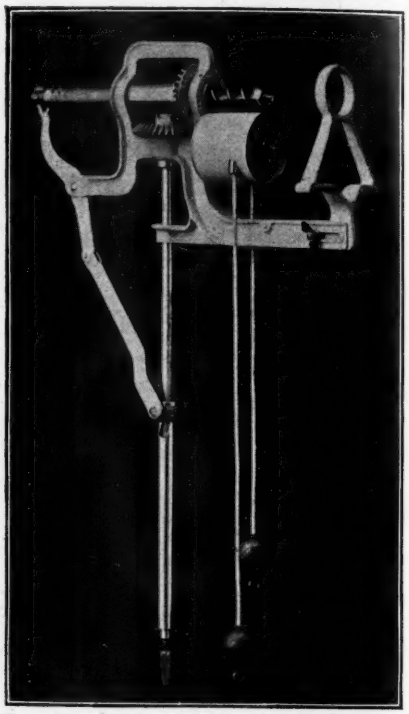
On these switchboards the General Electric Company's form "D" lever switch is used. This conforms with the underwriters' requirements, and has solid forged copper clip-blocks and studs. Blades are rigidly fastened to the crossbars. The blades, clip-blocks and studs are all given a ground finish. The handles of the switches are of hard wood, finished black. All switches are provided with fuses.

On these panels the ammeter is permanently connected in the generator circuit. The instrument supplied connected is the company's round dial indicator which is particularly adapted for long continued hard service. Its few parts are strongly constructed and have no springs; it is particularly free from liability to change. The scale is claimed to be of a most satisfactory character. When desired, voltmeters of a general design similar to the ammeters can be furnished.

An Automatic Joist-Boring Machine.

A novelty in an automatic joist-boring machine, intended primarily for the use of electric wiremen, is shown in the accompanying illustration. In operation the machine is secured in a brace by its lower squared extremity. It is then passed over the joist and a pull on one side of the cord which takes several turns about a worm enclosed in the cylinder bringing a spur into contact with the joist, clamping it to the projecting foot. The rotation of the brace is transmitted through proper bearings in the frame of the machine, turning the bit and at the same time the sleeve begins to climb up, being automatically rotated by a partial revolution of an enclosed spiral. This feeds the bit into the joist by means of the lever connected to the opposite end of the bit. The hole being bored, a reverse rotation of the brace withdraws the bit. A pull on the opposite cord withdraws the spur, and the machine is ready to be moved to a new location.

The projecting foot is quickly adjusted by means of a thumb-screw, but to take joists of various thicknesses the screw needs only to be adjusted for variations of



AUTOMATIC JOIST-BORING MACHINE.

an inch or more, the extension of the spur being ample to take care of smaller variations in thickness.

The entire machine, as shown, weighs but four pounds, and the inventor and patentee, Mr. J. C. Bonnett, of New Haven, Ct., claims for it remarkable efficiency and rapidity, with the further advantage of using the regular carpenter's brace bit, procurable at any hardware store.

Some Electric Railway Switch and Signal Apparatus.

In the accompanying illustrations are shown some new types of electrically operated switch and signal mechanism for railways, built by the Union Switch and Signal Company, of Swissvale, Pa.

In Fig. 1 is shown a type of machine known as the vertical rotary switch-circuit controller. This is designed especially for use in automatic rail-circuit block signaling, where the movement of a switch from the main line is required to hold at danger or to move to danger a signal or

signals governing the block in which the switch is located. As will be seen from the engravings, which clearly show the details of the apparatus, the cast-iron enclosing box is both dust and water-proof. All of the contacts are formed of heavy bronze strips tipped with platinum and are not subjected to vibratory movements as car wheels pass over the switch. This vibration in the present design is absorbed by the vertical rotary cam which is ordinarily disengaged from the contact-shifting apparatus, thus imparting no movement to it save when the switch is operated. The apparatus is made sufficiently heavy and strong to withstand blows from falling coal or other material which sometimes drops out of passing cars, and presents no obstruction to snow-plows or flanges when placed close to the rail. It can be set on either side of the track.

FIG. 1.—SWITCH BOX OF VERTICAL ROTARY SWITCH CIRCUIT CONTROLLER.

The instrument is usually furnished with four pairs of normally open contact springs. These are held open in service when the switch to which the instrument is attached is properly set for the main line. The opening of the switch points closes these contacts, thus establishing shunts, or other connections which are obvious, upon the track circuits.

Fig. 2 shows a type of controller similar to the above but designed to control from one to four separate circuits or to reverse the polarity of one or two independent circuits. The method of its operation is so clearly indicated by the engraving as to render description unnecessary.

In Figs. 3 and 4 are shown two views of the application of this controller to a mechanical signal electrically operated.

These circuit controllers are types of a very large number of electrical devices manufactured by the same company and in widespread use for railway work throughout the United States.

FIG. 2.—DUPLEX ROTARY CIRCUIT CONTROLLER.

FIGS. 3 AND 4.—DUPLEX ROTARY CIRCUIT CONTROLLER APPLIED TO MECHANICAL SIGNAL.

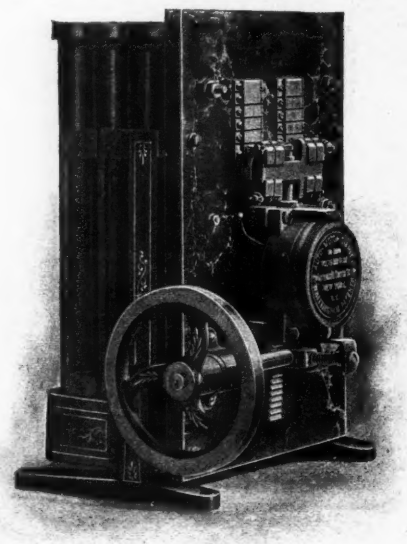
A Reversible Motor-Driven Automatic Motor Starter.

In the accompanying illustration is shown the Whittingham reversible motor-driven automatic motor starter, type "R," manufactured by the Automatic Switch Company, New York city. This starter is the result of considerable experience in the building of starters of the gravity or dash-pot type, and also of results obtained by the use of solenoid types of automatic starters as a means for reducing the resistance in series with the armature of shunt or compound-wound motors. This, the type "R" or ratchet controller starter, the manufacturer claims automatically to reduce the resistance in a regular progression at a speed which is dependent on the load on the motor.

This reduction is accomplished by means of a simple and powerful mechanical movement actuated by a pawl and eccentric driven from the motor armature. The engagement of this pawl with the arm carrying the head for controlling the resistance is brought about without using solenoid magnets or dash-pots. The use of the ratchet movement, giving a step by step acceleration over the different resistance contacts, ensures rapid and perfect contact with each graduation of the rheostat. The movement of this resistance arm is not dependent upon the acceleration of the speed of the armature, but is proportional with the load on the motor. Should the motor at the start be overloaded to such an extent as to stall it, there will be no movement of the resistance arm, the amount of current passing from the armature circuit thus being limited to a safe point.

One or more series coils are usually provided with elevator motors, which require heavy starting torque to overcome the inertia of moving parts and to produce a comparatively rapid start. To prevent the tendency which these coils might have to neutralize the field winding of the motor if it is driven as a generator by the overload of a descending car, it is customary in the construction of this type of starter to place a number of contacts at the top of the resistance for the purpose of short-circuiting the series coils, thus leaving the motor a plain shunt motor when running at full speed.

In elevator service it is particularly desirable to reinsert the starting resistance immediately when the current is broken, so that if the motor be reversed by a continuous movement of the operating mechanism there will be no possibility of throwing the current on in the opposite direction without the full resistance being inserted. This starter has few moving parts. The shaft is mounted in graphite bushed bearings and does not require oiling. The pawl is held in place by a spring adjustable for wear on the bolt passing through the spring and attaching the same to the frame of the magnet. The



RATCHET CONTROLLER MOTOR-DRIVEN AUTOMATIC MOTOR STARTER.

rack on which the pawl acts passes through openings directly back of the magnet so that when the magnet is de-energized it is free to separate in the opening so that when the current is cut off from the motor the rack will fall free from the contact pieces to the starting position.

The resistance used is composed of special iron wire wound in loose coils bedded in silica, and so placed in iron pipes as to result in excellent insulation and at the same time quickly radiate the heat and withstand heavy currents for short periods. Each tube is independently attached to the current-carrying contacts, and if necessary may be easily removed for repairs.

On all starters designed for 110 volts, above ten horse-power capacity, it has been found advisable not to depend upon the resistance contacts to carry the current continuously, but to short-circuit them by placing a retaining magnet at the end of the travel of the resistance arm adapted to hold a short-circuit after the resistance is cut off, at the same time disengaging the resistance arm which immediately drops to the starting point.

The Interstate Independent Telephone Association Meeting.

On April 9, 10 and 11 there will be held at the Sherman House, Chicago, a meeting of the operating independent telephone men of the middle western states. This meeting is for the purpose of forming a harmonious association of the various actual operating independent telephone interests of that section of the country, where by far the largest development of independent telephony has taken place. Present indications point to an unusually large attendance and to a very successful and interesting meeting. Many matters of moment and importance to the independent telephone field will be discussed and a permanent organization will be formed which will doubtless be of greatest importance and benefit in its field. A number of very elaborate exhibits are understood to be in course of preparation by manufacturers of telephones and telephone apparatus, and it is thought that the initial convention of the new association will be one of the most important meetings that has marked the history of the independent telephone movement. Arrangements have been made for special rates at the Sherman House, and it is probable that the meetings will be held in that hotel. It is thought also likely that reduced fare arrangements will be made with the railroads.

This meeting will include the independent telephone companies of the states of Illinois, Wisconsin, Michigan, Indiana, Kentucky, Missouri and Iowa. The Chicago telephone manufacturers, supply houses and manufacturers of kindred accessories have tendered a banquet and other suitable entertainment to the visitors. The Independent Telephone Association of Illinois and the similar association of the state of Wisconsin will gather at this time in a body. Invitations have been issued to every independent telephone man, emphasizing the importance of this occasion. All who expect to attend are requested to advise the chairman of the committee, 605 Marquette Building, Chicago.

American Institute of Electrical Engineers.

The one hundred and sixty-third meeting of the Institute was held on the evening of March 28 at the usual place in New York, and also in Chicago. The subject of the evening was "Telephony," and two papers were presented as follows: "Telephonic Status Quo," by Mr. A. V. Abbott, and "Telephone Rates from an Engineer's View," by Mr. Franz J. Dommerque, of Chicago.

CURRENT ELECTRICAL NEWS

COMMERCIAL NEWS

DOMESTIC AND EXPORT

CHICAGO TRACTION DEAL—Some 15,000 shares of the Chicago City Railway have been transferred to eastern capitalists. The purchasers have not been identified individually, but collectively they are known as belonging to the Elkins-Widener Syndicate that is in control of the Union Traction Company.

ELECTRIC STORAGE LIGHTS ON THE PENNSYLVANIA RAILROAD—The Pennsylvania Railroad has put in service, out of Pittsburgh, a train lighted throughout by electricity, operated by storage batteries under each car. The present batteries will supply lights for twelve hours, and improvements are expected to be made whereby batteries can be installed that will furnish lights for twenty-four hours. It is said that all the through equipment of the Pennsylvania Railroad will be furnished with these electric storage batteries.

ELECTRICAL POWER IN BOSTON—The annual report of the wire department of Boston, Mass., for the year 1901 presents among other interesting information a table showing the amount and distribution of Boston's electrical power. Statistics up to January 31, 1902, give the following figures: Total rated horse-power of boilers, 106,946; total rated horse-power of engines, 120,249; capacity in incandescent lamps, 739,779; capacity in arc lamps, 14,055; number of motors, 9,480; horse-power of motors, 145,565; number of stations, 306; the capacity of generators for isolated plants in kilowatts is 19,454.

AN ALASKAN WATER-POWER PLANT—Papers have been filed for the incorporation of the Juneau-Douglas Electric Company, capitalized for $1,000,000 in Seattle recently. The purpose of the company is to erect a water-power plant of a sufficient capacity to supply electricity to the amount of 5,000 horse-power. Light and power will be furnished to the towns of Juneau and Douglas, and to many mines in the vicinity of the two towns. The water-power plant will be at or near Juneau. In addition, the company will construct an electric railway to connect Juneau and Douglas, and the estimated cost of the plant will be about $750,000. The organizers are: A. B. Tleo and Colonel W. J. Southland, of Alaska, and W. E. Guerin, of Seattle.

A TRUST DEED FOR $1,000,000 has been filed, the Duluth General Electric Company, of Duluth, Minn., being party of the first part, and the Old Colony Trust Company, of Boston, is named as trustee. The mortgage, according to the instrument, was filed on account of the large standing indebtedness of the company at present, and the additional obligation it will incur by the acquisition of an electric light plant in this city, in buying stock in the Prindle Gas Company, in the Northern Electric Subway Company, and in the West Duluth Electric Company, and by the purchase of materials for extension of the plant. The board of directors has been authorized to issue first mortgage bonds of $1,000 each for a sum not to exceed $1,000,000, to run for twenty-five years, the interest being six per cent.

A LARGE TRANSMISSION OF POWER FOR MINING—Electrical power from the Missouri River dam, near Helena, Mont., is now being transmitted to Great Copper Camp where the Never Sweat, St. Lawrence, Anaconda and other mines of the Amalgamated Company are being lighted, and hoisting plants are being furnished with motor power, at a cost which is much lower than when power was developed by steam. A double pole line was constructed carrying six wires, for the purpose of transmitting electricity to Butte. These wires contain more than 1,000,000 pounds of copper. Eight thousand horse-power is being transmitted a distance of sixty-five miles, the pole line crossing the main range of the Rocky Mountains. The present dam and the Butte-Helena pole lines cost about $2,000,000. Preparations are being made for the construction of a second dam below the present one to meet the demands for additional power. The loss of power in transmission between the dam and Butte is about seven per cent.

WAR ON EXPOSED WIRES IN BROOKLYN AND NEW YORK — Commissioner J. Hampden Dougherty, of the department of water supply, gas and electricity, has begun a determined effort to have all wires used for electrical transmission of any description, and which may be exposed, placed in underground conduits. Last week a force of men was put at work and considerable telephone, telegraph and signal wire, principally that of small companies, has already been cut in the downtown section of Manhattan. It is understood that Commissioner Dougherty has written letters to the officials of the Brooklyn Rapid Transit Company, the Edison Illuminating Company, the New York & New Jersey Telephone Company and the Western Union and Postal Telegraph companies operating in Brooklyn, requesting the officials of these companies to meet him in conference with a view of devising plans for putting all overhead wires in the borough of Brooklyn underground. Approximately seventy per cent of the wires of the New York & New Jersey Telephone Company are already underground, the balance, which are aerial wires, being for the most part located in outlying districts of the city. This is substantially the case also with the Western Union and Postal Telegraph companies in Brooklyn. To reconstruct the Brooklyn Rapid Transit's entire system, however, so as to make it an underground instead of an overhead trolley system, it is believed that the cost would be about $22,000,000. No imperative order has been issued as yet in Brooklyn, as under the charter of the greater city the commissioner has not the right to issue such an order to companies operating within the limits of Brooklyn, Queens and Richmond, the Board of Estimate and Apportionment having authority to issue the order, but not until all persons or corporations interested shall be given a due opportunity for hearing.

ELECTRIC LIGHTING

SANTA FE, N. M.—Manager I. Sparks, of the Santa Fe Water and Light Company, it has been announced, will double the capacity of the Santa Fe Electric Light plant this spring.

TRENTON, N. J.—The American Cigar factories of Trenton and Camden, N. J., will be lighted electrically. Messrs. Hyde & Bennett, of Trenton, have secured the contract for 160 arc and 1,300 incandescent lamps.

ESCANABA, MICH.—A plan to bond this city for $6,000 to redeem outstanding light plant bonds and make improvements in the manufacturing plant has been voted down and the plant will be sold to a corporation or will revert to the original owners.

MILWAUKEE, WIS.—John I. Beggs has been chosen president of the Milwaukee Electric Railway and Light Company to succeed William Nelson Cromwell. Henry C. Payne has resigned as first vice-president, and Mr. Cromwell takes the office formerly held by Mr. Payne.

CLYDE, N. Y.—The board of village trustees at a regular meeting recently voted to accept the proposition of the Wayne County Electric Company. The contract is for all-night lighting at $4,000, for the remaining four years, and the vote authorizes the payment of $3,000 for the current year.

SEATTLE, WASH.—The city council has granted the Shuffleton electric light franchise for a new electric lighting system, that will cover the whole city and for a term of fifty years. The ordinance provides that within three years enough wires must be installed to cover a district equal to that served by the present system.

SAN JOSE, CAL.—A new electric light corporation is in the field in the Santa Clara Valley and the counties along the Coast Railway for the purchase and acquirement of local plants. The plant of the Salinas Gas, Water and Electric Company has been purchased, and it is the plan of the promoters to acquire all of the local electric industries.

LONG BRANCH, N. J.—The Steinbach Company, of Asbury Park, has awarded the contract for installing the new electric light plant to the Standard Heating and Engineering Company, of Lancaster, Pa. The plant will be located in the Mammoth store, and will heat and light that building, as well as the structure to be erected across the street at Bangs avenue and Emory street.

SELMA, ALA.—The plant of the Selma Electric Light and Power Company has been purchased by W. D. Pender, of Norfolk, Va., S. L. Pender, of Selma, and a company of Virginia and Pennsylvania capitalists. The new owners have taken charge of the electric light plant and will immediately begin enlarging and improving the system. This company is also negotiating for the purchase of an electric light and waterworks plant in Meridian, Miss.

ELECTRIC RAILWAYS

CLEVELAND, OHIO—The three-cent-fare bill has been finally passed by the city council. Mayor Johnson, who is interested in the company, has stated that operations of building the new lines would begin within a month.

LITTLE FALLS, MINN.—The Minnesota Midland Electric Railway Company has completed plans for constructing its electric line in this city, and having it ready for operation as soon as the new steel bridge over the river is completed by the city.

FREDERICK, MD.—The board of aldermen, at a special meeting, granted the Baltimore & Frederick Electric Railway Company a franchise for the use of certain streets of the city. Work is to be begun within six months and is to be completed within eighteen months.

STAMFORD, N. Y.—The survey for the extension of the Oneonta, Cooperstown & Richfield Springs trolley road to Mohawk has been completed, and the company has by a vote decided to build the road. The capital stock of the company will be increased from $1,000,000 to $1,500,000.

MILWAUKEE, WIS.—Six additional franchises over city streets have been granted to the Milwaukee Electric Railway and Light Company by the common council. There was some opposition on the part of Aldermen Stiglbauer and Fass to granting the franchises, but the final vote in favor stood 32 to 13.

JACKSONVILLE, FLA.—It has been announced that a project is being promoted by a company which proposes to build an electric car system, which is to operate from Sanford to Kissimmee, a distance of forty-three miles. This concern, which has already obtained a charter, is known as the Sanford, Orlando, Kissimmee & Southern Railroad and Steamship Company.

ONEONTA, N. Y.—The Oneonta, Cooperstown & Richfield Springs trolley road is considering an extension of fourteen miles from Richfield to Mohawk, where it will connect with the West Shore and possibly become an important link in the traffic from this section to the north and west. H. S. Jennings, acting manager, and Owen Phillips, chief engineer, have been looking over the route and it is expected that a survey will be completed at an early day.

SYRACUSE, N. Y.—An application for an increase of capital stock of the Interurban railroad from $250,000 to $1,000,000 was made recently before the State Railroad Commission at Albany by Attorney W. P. Goodelle and Engineer Thomas H. Mather. It is understood that the application means extensive improvements and a further extension of this road, which is now in operation between Auburn and Skaneateles, while the work between Skaneateles and Marcellus is nearly finished.

CLEVELAND, OHIO—A meeting of the stockholders of the Cleveland, Painesville & Eastern Electric Railway Company will be held April 10 for the purpose of increasing the capitalization of the company from $1,500,000 to $2,000,000. The object is to give additional working capital for the extension of the line and to liquidate and pay off the unfunded and floating debt and other liabilities incurred in the construction and equipment of the road. As soon as the capital is increased bonds will be issued for the amount required. The direct purpose of this increase is to complete the Painesville & Fairport line now under construction.

SHELBYVILLE, IND.—The Shelbyville interurban line has signed a contract with the Indianapolis Street Railway Company for the use of its tracks for the new line's interurban cars, when they begin running into this city. The Shelbyville line will have to pay the Indianapolis company only three cents out of every city fare, while the Union Traction Company, under its contract, pays three and one-half cents. This concession was made after the Indianapolis and Shelbyville companies had made repeated efforts to come to other terms. The Indianapolis company also agrees to remove its poles from the centre of the streets for the Shelbyville line, while the Union Traction Company had to do this work itself.

LEGAL NOTES

CONSIGNMENT OF PATENT—In Bennett *vs.* Wortman, 2 Ont. Law Rep. Can. 292, it is held that the assignee of a patent right, for a limited period with the right of purchase and reassigns the patent, can not thereafter sell the patented article though made by him during the time he was assignee, as his right to make and sell is to be restricted to the period limited.

OWNERS OF WATER RIGHTS—Riparian owners along a stream of water, the flow of which has been diverted from its natural channel, or obstructed by a permanent dam, which has continued for the time necessary to establish a prescriptive right to perpetually maintain the same, who have improved their property in reliance upon the continuance thereof, are held in Kray *vs.* Muggli (Minn.), 54 L. R. A. 473, to acquire a reciprocal right to have the artificial conditions remain undisturbed.

RAILROAD RIGHT OF WAY—A railroad right of way is held in Southern P. Company *vs.* Hyatt (Cal.), 54 L. R. H. 522, to be of such a public nature that title thereto can not be acquired against the company by prescription or the running of the statute of limitations. Adverse possession of a portion of a railroad right of way for a period exceeding that designated by the statute of limitations for the recovery of real property is held in Northern P. R. Company *vs.* Ely (Wash.), 54 L. R. A. 526, to bar a right of action to recover possession thereof.

AUTOMOBILE NOTE

AUTOMOBILE SHOW—The next automobile show in New York city will be held during the third week in January, 1903, at Madison Square Garden. It will be given under the auspices of the Automobile Club of America and the National Association of Automobile Manufacturers, and the management will be jointly in the hands of these two organizations and the Madison Square Garden Company.

NEW INCORPORATIONS

INDIANAPOLIS, IND.—Boswell Electric Light and Waterworks Company. $25,000. Directors: E. W. Williamson, Philip J. Shaw and B. H. Bennett.

ALBANY, N. Y.—Massena Electric Steel Company, Syracuse. Capital, $500,000. Directors: M. R. Conley, D. P. Facktor, and T. T. Seeley, New York city.

ALBANY, N. Y.—Fulton Light, Heat and Power Company. To operate in Syracuse, Fulton, Oswego and towns and villages of Onondaga and Oswego counties. $150,000.

KIMBALL, S. D.—The city council of Kimball has granted to the Brule County Telephone Company a franchise for establishing and maintaining franchise for a local telephone system.

ALBANY, N. Y.—Penn Yan & Lake Keuka Electric Railway, Penn Yan (twelve-mile electric road). Capital, $120,000. Directors: P. A. McCrea, Buffalo; A. E. Gokey, J. W. Borst, Painted Post.

SPRINGFIELD, ILL.—Western Illinois Traction Company, Monmouth; $10,000; incorporators: W. W. McCullough, W. B. Young, S. S. Hallam. Harvard Electric Company, Chicago; capital increased from $10,000 to $50,000.

ELKTON, MD.—The Newark, Elkton & Eastern Shore Railway Company, of Cecil County. Incorporators: Joseph H. Steele and Charles S. Elliason, of Chesapeake City; Albert Constable, Jr., Joshua Clayton and John G. Williams, of Elkton.

FAIRMOUNT, S. D.—The Fairmount Cooperative Telephone Company. $5,000. Incorporators: C. E. Rubert, George Ally, Frank Palton, R. P. Burton, Eber Wilde, George Bonney, Enos Alley, R. E. Dowdell, John T. Kean, E. M. Smith and others.

LOS ANGELES, CAL.—The Pacific Light and Power Company. $10,000,000, divided into $100 shares, of which amount $70,000 has been subscribed. Directors: H. E. Huntington, I. W. Hellman, A. Borel, Chr. de Guigne, San Francisco; William G. Kerckhoff, Kaspare Cohn and H. W. O'Melveny, Los Angeles. Each director subscribes $10,000.

TRENTON, N. J.—The Cincinnati, Newport & Covington Light and Traction Company. $10,000,000. To construct and operate street railways and to furnish electric lights. Of the stock $5,000,000 is preferred, with four and one-half per cent non-cumulative dividend. The incorporators are: E. T. McLaughlin, of Jersey City; Henry W. Clark, of New York, and James C. Converse, of New York.

BRYAN, TEX.—The Southwestern Telephone and Telegraph Company has effected an arrangement with the local independent telephone company, by means of which the business of the long-distance lines will be handled through the local exchange, giving all business houses and residences having telephones in Bryan long-distance connections. Telephones will be installed as rapidly as possible, and the new arrangement will go into effect April 1.

ELECTRICAL SECURITIES

The past week has again witnessed much improvement, a more hopeful feeling existing and a good advance in prices being made. Although the outside public persistently stays out of the market, the continued upward sentiment prevailing will undoubtedly tend to attract a decidedly larger commission business.

It appears as if the recent apprehensions which have been more or less seriously entertained as to the beginning of a national retrograde movement have been greatly allayed and the feeling predominates that the public has plenty of money, is enjoying a continued prosperity, and this will soon be felt in the market in the event of a sustained bull movement.

Unsettled and uncertain as to its outcome, the one problem which underlies all industrial and financial expectations in the United States, and with very little hope of its early settlement, is the momentous problem of the Northern Securities Company. It is believed that nothing will be done to disturb the highly important railroad industry, and large interests, despite an apparent equanimity, are watching these proceedings very closely.

General trade conditions continue favorable, and the market is in strong hands. Everything considered, there seems to be no reason why the professional bull predictions should not be fulfilled.

ELECTRICAL SECURITIES FOR WEEK ENDING MARCH 22.

New York:	Closing.
Brooklyn R. T.	65⅝
Con. Gas	223⅝
Gen. Elec	321
Man. El	132⅞
Met. St. Ry	167½
N. Y. & N. J. Tel. Co	168
Telep., Tel. & Cbl. Co	5
Westinghouse Mfg. pf	197
Kings Co. Elec	196

Both Westinghouse and General Electric still remain live features of the market, General Electric rising to 321.

An overwhelming majority vote of the stockholders of the Metropolitan Street Railway Company has ratified the lease of the company's system to the Interurban Street Railway Company and authorized the issue of a $65,000,000 mortgage on the property of the company.

Stockholders of the Brooklyn Rapid Transit Company have authorized the issue of a new refunding mortgage. The present debt of the company is $61,065,000, so there will remain the proceeds of almost $90,000,000 in bonds to be used to extend and improve the property.

Boston:	Closing.
Am. Telep. & Tel	168½
Edison Elec	270
New England Tel	147
Mass. Elec. pf	97
Western Telephone & Telegraph	92

Massachusetts Electric, Edison Electric, and American Telephone and Telegraph have been especially strong, with prospects of continued firmness and even of greater advance. The annual report is very gratifying for stockholders in American Telephone and Telegraph, showing increase of almost $2,000,000 in net earnings.

Philadelphia:	Closing.
Elec. Co. of America	7
Philadelphia Elec	4¾
Union Traction	39½
United G. I. Co.	122½
Elec. Stor. Bat. c	64
Elec. Stor. Bat. pf	65

The Electric Storage Battery annual report for 1901, made to the stockholders, shows net earnings to be 3.4 per cent on the $16,248,200 capital stock. Notwithstanding what is in some quarters considered a not very favorable report, the bidding up of this stock was a feature of the market. United Gas Improvement moved up again, touching 122½.

Chicago:	Closing.
Central Union Tel	40
Chicago Edison Light	170
Chicago Telep	185
Metropolitan El. pf	91¼
National Carbon	23
National Carbon pf	87½
Union Traction	19½
Union Traction pf	50½

Union Traction common has been in good demand, but it is suggested that recent buying of these interests for eastern holders has had much to do with creating a favorable condition for these stocks.

PERSONAL MENTION

MR. CHARLES J. WELLS has resigned his position with the Shelby Electric Company and has accepted a position as traveling salesman to the Buckeye Electric Company, Cleveland, Ohio.

MR. CHARLES A. BROWN, the well-known patent attorney of Chicago, has formed an alliance with Mr. George L. Cragg, and the firm will be known as Charles A. Brown & Cragg. Messrs. Brown & Cragg will have their offices in the Monadnock Block, Chicago.

MR. U. N. BETHELL, president of the Chesapeake & Potomac Telephone Company, Baltimore, was for several years a practising attorney. Recently he was admitted to practice before the Supreme Court of the United States on the motion of Ex-Attorney-General Griggs.

MR. W. C. WOODWARD and Mr. Mark Lowd, Providence, R. I., both of whom are connected with the Narragansett Electric Lighting Company—Mr. Woodward as chief electrical engineer and general superintendent, and Mr. Lowd as engineer in charge of underground construction—were New York visitors last week..

MR. A. E. STILLWELL, president of the projected Kansas City, Mexico & Orient Railway, and the party of Englishmen, including Lord Munson, of London, who accompanied him to this country recently, were given an elaborate banquet recently by the Commercial Club. Three hundred plates were laid and among the guests present were Governor Stanley, of Kansas; F. Stanley Young, British Consul in Kansas City; Colonel J. R. Skinner, of the British Army, and Captains H. G. Cote, W. H. Dean and A. L. Berry, of the United States Army. President Stillwell, Lord Munson, and several others responded to toasts.

TELEPHONE AND TELEGRAPH

MEDINA, N. Y.—The Home Telephone Company's poles are now up in the village limits, and those who have charge of affairs claim they will be in running order by the first of June.

ELIZABETH, N. J.—The Elizabeth Mutual Telephone Company has recently terminated its existence. The organization will hereafter be known as the Interstate Telephone Company.

CIRCLEVILLE, OHIO—The Citizens' Telephone Company, of Circleville, is now building a line from that city to Laurelville and Adelphi. A branch line is also being built from Stringtown to Tarlton.

WASHINGTON, PA.—The Federal Telephone Company has made connection to Finleyville and Courtney, and the circuit will soon be arranged so that Washington and Monongahela may likely be connected this month.

TERRE HAUTE, IND.—A direct copper wire circuit has been established between this city and Indianapolis through the independent telephone companies, through the station at Indianapolis, with all of the more important cities in the state.

NEWTOWN, PA.—The Standard Telephone Company has been granted a franchise covering a number of streets in Langhorn, and an extension of ninety days in its franchise for Sellersville, which provided that the system there should be completed by March 11.

WILMINGTON, N. C.—The Southern Bell Telephone and Telegraph Company will operate a line to Carolina Beach this summer. The company controls and will utilize the line put up for the government in 1898 for war purposes, and will probably put in three pay stations at the beach.

JOHNSTOWN, PA.—The Indiana Telephone Company will shortly make extensive repairs on the line from Indiana to Johnstown. Ninety miles of copper wire have been purchased and a metallic circuit to Johnstown will be established. Poles to rebuild the line between Mechanicsburg and Homer City have been contracted for.

DETROIT, MICH.—The Circuit Court has handed down a decision saying that the Michigan Telephone Company must serve the subscribers of the Detroit Telephone Company, an independent company which the Michigan people absorbed. The Michigan company refused to give the independent subscribers service unless they used two telephones. The decision means that the subscribers can have the service of both companies for one rate.

WILLMAR, MINN.—At a meeting of the stockholders of the Minnesota Central Telephone Company it was voted to increase the capital stock of the company to $300,000, for the purpose of purchasing the properties of the Northern, Southern & Minnesota Electric and the Western Minnesota Telephone companies. The consolidated companies are to be operated under the name of the Minnesota Central Telephone Company, which will have 2,000 miles of toll line in sixteen counties of the state, with thirty local exchanges.

INDUSTRIAL ITEMS

A. MIETZ, New York city, is the manufacturer of the Mietz & Weiss kerosene engine. This engine received the highest award for direct-coupled generator set at the Paris Exposition of 1900.

THE C. W. HUNT COMPANY, of West New Brighton, Staten Island N. Y., has recently received an order from the United Railways and Electric Company, Baltimore, Md., for a set of electric hoisting machinery. This is a repeat order.

THE ELECTRIC APPLIANCE COMPANY, Chicago, Ill., distributing agent for the Gutmann alternating-current integrating wattmeters, states that it has so increased its facilities that its factory is now able to fill all orders promptly.

THE AMERICAN VULCANIZED FIBRE COMPANY, Wilmington, Del., has taken charge of the sales and purchasing departments of the American Hard Fibre Company, of Newark, Del., and the Kartavert Manufacturing Company, Wilmington.

THE STROMBERG-CARLSON TELEPHONE MANUFACTURING COMPANY, Chicago, Ill., it is announced, has disposed of its interests to a number of Rochester business men. There is some likelihood of a portion of the plant being transferred to Rochester.

THE INTERNATIONAL MOTOR CAR COMPANY, Toledo, Ohio, manufacturer of steam, hydrocarbon and electric automobiles, announces that its Washington branch will have an extensive exhibit at the Automobile Show to be held in Washington from April 7 to 12, inclusive.

THE ALLIS-CHALMERS COMPANY, Chicago, Ill., illustrates and describes in catalogue No. 7, the uses of perforated metal in place of wire cloth and netting. The book is handsomely printed, with the cover in colors, and bears the characteristic seal of this company.

THE AMERICAN INSULATED WIRE AND CABLE COMPANY, Chicago, Ill., has bought under order of the court the machinery and stock of the Illinois Insulated Wire Company, which was recently placed in the hands of a receiver. The American company is enlarging its factory at 241 South Jefferson street, and will rapidly increase its force of operatives.

THE RACINE HARDWARE COMPANY, Racine, Wis., has issued, and is mailing to those who ask for it, Bulletin No. 100, which describes and beautifully illustrates the high-grade "automatic engines" which this well-known firm manufactures. Numerous high-grade cuts illustrate these engines coupled with a number of standard generators. The bulletin is well worth possessing and preserving.

THE TRIUMPH ELECTRIC COMPANY, Cincinnati, Ohio, manufacturer of electric light and power machinery, has opened an eastern office at 39 Cortlandt street, New York city, placing the same in charge of Mr. J. P. Burkhardt. This has been found necessary owing to the great increase in the company's eastern business. Mr. Burkhardt has had a wide experience in handling this company's apparatus.

THE WILLIAM A. HARRIS STEAM ENGINE COMPANY, Providence, R. I., is exhibiting at its works the ten-horse-power, cross-compound, condensing, heavy-duty Harris-Corliss engine designed for Clemson College, the State Agricultural and Mechanical College of South Carolina. The faculty of the college is issuing an invitation to visit the works during the week commencing March 31, between the evening hours of seven and ten.

THE AMERICAN TRADING COMPANY, Amsterdam, Holland, has established a manufacturers' sample exhibition in that city for the general advancement of American manufactures and the extension of American export trade. The company is desirous of correspondence with manufacturers who wish to place a permanent sample exhibit of their goods in a neutral country in Europe where they may easily be inspected and from which place they may be sold.

THE POTOMAC TERRA COTTA COMPANY, Washington, D. C., reports the season's demands for conduits heavier than in many years; in fact this company is operating to its fullest capacity to meet its demands. Among the orders accepted is a large one to supply the United Engineering and Contracting Company with the conduit necessary for the construction of the section of the Long Island Railroad at Brooklyn, for which it has the contract.

THE UNION ELECTRIC MANUFACTURING COMPANY, Milwaukee, Wis., announces that its factory is now in operation, and is turning out electric motor controlling devices of all kinds, comprising controllers for electrically operated cranes and elevators, printing-presses, pumps, theatre lighting, and machine tools. The company claims to possess some patents which will make its machines very acceptable to the trade. It courts investigation and will gladly answer all enquiries.

THE GOULD STORAGE BATTERY COMPANY, New York city, has secured a contract for an installation of 255 cells, with a capacity of 100 kilowatts, and a tank capacity of 140 kilowatts, for the Kutztown & Fleetwood Street Railway Company. The battery is on a line fed by a booster from the power station. Also a battery of 244 cells, having a capacity of 100 kilowatts, with a tank capacity of 125 kilowatts, to be used as a floating battery for the Allentown & Kutztown Street Railway Company, of Allentown, Pa.

THE LEHIGH VALLEY RAILROAD announces that its old Mauch Chunk station will be abandoned, and all passenger business in future will be conducted at the station that has been heretofore known as East Mauch Chunk. This move has been contemplated for some time, owing to the extreme curve at the old station, which required a helper to start heavy trains out of the station. The present station at which passenger trains stop at Mauch Chunk is more conveniently located to the city than the old one.

THE WESTERN ELECTRICAL SUPPLY COMPANY, St. Louis, Mo., reports that it is anticipating an extremely heavy demand for supplies and construction material in spring work, and has laid in a very large stock of this material, and is prepared to furnish promptly from St. Louis a complete line of wires and cables, cross-arms, cross-arm braces, insulators, construction tools of every description, overhead material for electric railways, and in fact everything pertaining to outside electrical construction. Also carrying a very large stock of rubber-covered wires and cables, conduit and fittings, outlet and switch boxes and kindred material. Complete catalogues will be mailed on application.

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia, Pa., has, within the last few weeks, closed the following contracts for storage batteries to be used for trolley regulation: The Altoona & Logan Valley Railway, Altoona, Pa.; Allegheny County Light Company, Pittsburgh, Pa.; Pittsburgh Railway, Pittsburgh, Pa.; Sandusky, Monroeville, Bellevue & Norwalk Traction Company (two batteries), Sandusky, Ohio; Parkersburg & Interurban Railroad, Parkersburg, W. Va.; United Electric Company, Newark, N. J.; Pueblo Traction and Lighting Company, Pueblo, Col.; Boston & Maine Railroad, Concord, N. H.; Camden Interstate Railway (two batteries), Huntingdon, W. Va.; Seattle Electric Company, Seattle, Wash.; Seattle & Tacoma Interurban Railway (three batteries), Seattle, Wash.

THE IROQUOIS MACHINE COMPANY has just been incorporated as a New York company, having been organized by Mr. W. W. Gibbs, who is also vice-president of the Kidder Press Company and a member of Gibbs-Brower Company, of New York city. The officers are: Edwin A. Smith, president, who is a prominent banker in Providence, R. I.; W. W. Gibbs, vice-president and general manager, New York; Henry C. Babcock, secretary and treasurer, Providence, R. I. Principal office, 150 Nassau street, New York. The company will manufacture new and improved wire drawing machinery, which it claims will materially reduce the cost of producing wire. It will also manufacture a full line of automatic and plain drop hammers, swaging machines, rolling mills, roller bearings and grinding machines. Having ample capital, it has purchased the plant and business of the Universal Machine Company, located at Providence, and rented a large additional building adjacent. The purchase of this running plant, and the addition named, will ensure to customers prompt filling of their orders. A new factory building will probably be erected during the coming summer.

OBITUARY NOTICE

MR. NELSON M. BEACH, treasurer and general manager of the Bridgeport Brass Company, died suddenly at his home in Bridgeport, Ct., March 19, of an attack of heart failure. Mr. Beach was in his forty-eighth year and was widely known among the electrical fraternity.